Strengthening teaching competencies

DIDACTIC AND PEDAGOGICAL COMPETENCIES

DOCUMENT CONTROL SHEET

CONTENTS

PREFACE

These guidelines and instructions for strengthening of didactic-pedagogical competences are prepared within the Erasmus+ project "Strengthening Teaching Competences in Higher Education in Natural and Mathematical Sciences - TeComp".

The TeComp project is envisaged as a regional-scale project in Serbia and Albania whose clear goal is to improve the quality of teaching and learning, in the field of natural and mathematical sciences at the partner country universities, in line with advance EU practices.

One of the main project tasks is improving the didactic-pedagogical competences introducing the contemporary methods that are already in wider use in EU. This booklet is prepared by teachers from Serbia that adopted the new methods using the experience from EU colleagues.

This booklet contains chapters that are of special importance to young teachers in mathematics and natural sciences. There are general chapters, dealing with modernisation of teaching and learning in the European Higher Education Area, some chapters with particular areas: as preparation of teaching materials (textbooks) and assessment of student knowledge. Then there are several topics connected to interactive teaching and learning, effective pedagogical communication, constructivist approach to teaching and learning in higher education and difficulties and challenges of inclusion in higher education.

Principles and guidelines that are presented in this publication are intended to help teachers and students to incorporate in their teaching routine several new teaching tools available for teaching in natural sciences and mathematics.

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QUESTIONS:

Why are changes necessary?

What are the key things that need to be changed or improved?

What is the role of higher education teachers in modernisation?

What is the role of students in moder-nisation?

What kind of support should be received from higher education institutions and governments?

What is the role of technology and new pedagogical tools in modernisation?

Modernisation of teaching and learning in the European Higher Education Area

Content

Introduction

    Europe has a long tradition of what we call now higher education. The roots of today's higher education lie in the monastic schools from the sixth century, from which the medieval European universities later developed, starting with the University of Bologna, founded in 1088. And from there, the modern sys-tem of higher education of today later evolved. The biggest change that has happened over time has been the approach. Until the 20th century, university education cared for a small number of elites. The 19th century university was designed to serve no more than 2% of the population attending university at that time. However, the context in which higher education takes place today has changed dramat-ically. Europe is facing significant challenges: the economic crisis, unemployment, especially for young people, demographic change, the emergence of new competitors, new technologies and ways of work-ing… In response, more creative, innovative and flexible young people are needed, with entrepreneurial knowledge and skills, who are ready for the challenges of today's changing work environment. There-fore, the European Union agreed that at least 40% of young people should have a university-level quali-fication. However, the ambition to significantly increase the number of those entering and completing higher education only makes sense if it is accompanied by a determination to ensure that teaching and learning in higher education is the best possible. Ensuring high quality teaching and learning is a central issue in the modernisation of higher education in the European Education Area - with a focus on study programs that provide relevant, up-to-date knowledge and skills, knowledge that is globally connected, usable in the labor market and provide a basis for continuous learning of graduates.

    Achieving this is no easy task. Michael Hooker argued in 1997 that the nineteenth-century model of higher education teaching still prevailed and that teaching had not changed much since then. According to him, "basically, higher education is still a process of transferring knowledge through teaching to those who want to acquire it." The last two decades have seen progress in many higher

education institu-tions, but the basic model has not changed significantly, at least not in most institutions. However, peda-gogical models designed for small institutions serving a small elite must be adapted to the much more diverse needs of large numbers of students, greater diversification and specialization in higher educa-tion, new forms of delivery involving technology, modern educational programs, and huge changes in science, technology, medicine, social and political sciences, the world of work ... In addition, what is known is no longer stable, the duration of knowledge can be very short, and in many disciplines what is taught lurks the threat of obsolescence.

In order to examine ways to improve the quality of higher education in the European Higher Education Area, in 2012 the European Commission established the *High Level Group on the Modernization of Higher Education*, hereinafter *HLG*. This group had three basic tasks. The first was to launch a wider debate in all EU Member States on the quality of teaching and learning at all universities and colleges. The second task was to identify a number of initiatives that could be implemented taking into account the different starting points of different countries and institutions. Finally, the third task was to make recommendations on how the European Union can support governments and other stakeholders in implementing new, more challenging and better models of teaching and learning. HLG successfully completed these tasks and published the results in the form of two reports. The first report, entitled *Report to the European Commission on Improving the Quality of Teaching and Learning in European Higher Education Institutions*, was published in 2013. and the second one, entitled *Report of the Euro-pean Commission on New Modes of Learning and Teaching in Higher Education*, was published in 2014. In this text, we talk about the main details from these reports, especially about the analyzes con-ducted by HLG and the conclusions and recommendations it formulated.

The basic principles formulated by the HLG, as principles that should be a guide in the modernisation of teaching and learning in the European Higher Education Area, are the following:

   that teaching and learning are key essential missions of our universities and faculties;

   that the active involvement of students is essential in the management, curriculum design, program development, quality assurance and review procedures;

   that favoring research over teaching in defining academic merit should be balanced;

   that academic staff is not only employed to teach, but also to teach well, in accordance with high professional standards;

   that it is a key responsibility of higher education institutions to ensure that their academic staff is well trained and qualified as professional educators, and not just qualified in a particular academic subject;

   that this responsibility extends to ensuring new staff have a teaching qualification or its equivalent at the beginning of their academic career, or to provide them with teacher education courses in the early years of their careers;

   that this responsibility extends to providing opportunities for continuous professional career devel-opment as a professional teacher, and not just as a teacher for a particular subject or discipline;

   that the key responsibility of academic staff is to ensure that they are qualified to teach and able to teach well; and

   that this responsibility extends to their entire career from beginning to end, so that they stay up to date and know the best pedagogical practices and all that excellence in teaching requires.

These principles will be explained in more detail below.

Improving the quality of teaching and learning

Teaching competencies of teaching staff in higher education

Higher education institutions within the European Higher Education Area are very diverse in their sizes, budgets, missions and goals, not only between individual countries but also within them? Given this level of disparity in the higher education sector, it can be very difficult to define standards of quality teaching and learning that will suit all higher education institutions. However, this does not justify the reluctance, present in many higher education institutions, to recognize the need for professional teach-ing skills for those who are already teaching or who intend to become teachers in higher education. The need for professional development for primary and secondary school teachers is generally taken for granted, but it is very often considered that such professional development in higher education is not necessary, as if it is something unworthy of a university teacher.

In most countries of the European Higher Education Area, academic careers are much more closely linked to research than to teaching in terms of initial selection in a job interview or competition and subsequent performance-related promotion and rewarding. Doctoral students and those who are engaged in postdoctoral research quickly realize that academic recognitions are primarily gained by participating in ambitious research projects and regular publication of scientific papers. On the other hand, teaching undergraduate students is considered by many to be a task that should primarily be performed by those who are at the beginning of their academic career, and less often by more experienced professors. Those who are under pressure to publish the results of their research within the given deadlines (in accordance with the imperative "publish or perish") can consider teaching, assessments, and student contact hours as holding them back from what their employers really give priority to. In such a situation, students can easily see themselves as a nuisance to a busy teacher who must meet the deadline for publishing a scientific article. Research has shown that a serious commitment to best practice in carrying out the basic academic mission – teaching and learning – is not universal, it is sporadic at best and usually relies on the commitment of only a few individuals.

HLG points out that there is an urgent need to change the way of thinking in many countries and their higher education institutions regarding the priorities of academic teaching and learning compared to research. Excessive focus on research seems to have overshadowed the essential value and fundamental importance of teaching. It is imperative that we return to that core value, to see clearly again how impor-tant teaching is and how dangerously close we are to taking it for granted. Favoring research in relation to teaching in defining academic merit, which is reflected in the lack of importance attached to teaching skills in selecting, hiring and improving academic staff, results in extremely modest attention paid to the preparation of future higher education teachers in terms of didactic training. Compared to first- and second-level teachers, higher education teachers often feel alone, and are really alone, without adequate preparation for a number of tasks (communication, preparation of materials, methodology, technology, assessment, exams, structure and pace of the course, feedback, etc.) faced by each teacher.

Notwithstanding these and other problematic issues, in recent years, many European higher education institutions have seen positive developments in terms of the importance attached to teaching

and learning. More and more universities are demanding proof of teaching skills from job candidates and their consent to continuously update them. Some higher education institutions have established mentor-ing systems and the introduction of new teachers to improve their integration into higher education institutions and their pedagogical skills. Academic staff are sometimes encouraged or required to have a teaching portfolio in which they will present a personal view of their own teaching methods, successes and shortcomings, as well as the needs and expectations of students. Some institutions publish the extent to which their teaching staff is professionally trained or qualified as teachers, and other measure and evaluate the quality of teaching. Overall, a variety of policies and initiatives have been adopted across the European Higher Education Area to promote the quality of teaching and learning in higher educa-tion. They range from national strategies and programs, institutional missions, national and institutional awards, to reward systems, teacher training and centers of excellence in teaching, including, most im-portantly, pedagogical research.

As mentioned in the introduction, HLG has identified that the key responsibility of higher education institutions is to ensure that their academic staff is well trained and qualified as professional educators, and not just qualified for a particular academic subject. Those who work as teachers in the higher educa-tion sector are professional teachers, just as school teachers are, and just like school teachers, they need special training that benefits them to do their job pedagogically well. This is even more important be-cause the student body is not only growing rapidly, but is also becoming more diverse in terms of cultu-ral, economic and social background, and increasingly demanding in terms of what students expect from their courses and their teachers. Therefore, HLG considers it necessary to provide conditions for new staff to acquire a teaching qualification or its equivalent at the very beginning of their academic career, or to provide teacher education courses in the early years of their careers, as well as to provide opportunities for all other teaching staff for continuous professional career development, as professional educators, not just as teachers for a particular subject or discipline. On the other hand, the key responsi-bility of academic staff is to ensure that they are qualified to teach and able to teach well, as well as that they will be so throughout their careers, that they will stay up to date and master the best pedagogical practices and all that excellence in teaching requires.

HLG recommendations:

Every institution should develop and implement a strategy for the support and on-going improvement of the quality of teaching and learning, devoting the necessary level of human and financial resources to the task, and integrating this priority in its overall mission, giving teaching due parity with research.

All staff teaching in higher education institutions should have received certified pedagogical training. Continuous professional education as teachers should become a requirement for teachers in the higher education sector.

Academic staff entrance, progression and promotion decisions should take account of an assessment of teaching performance alongside other factors.

Researchers who are intending a career in academia should be given the opportunity to gain professional teaching qualifications and be supported in teaching activities alongside their research..

Examples of good practice:

In Spain, *Strategy University 2015* is a government initiative to modernize universities through the coordination of the autonomous regional university systems and the development of a modern Spanish University System. One of its priorities is quality assurance in teaching, through the assessment, certification and accreditation of institutions, teachers and programmes, carried out by *the Quality Assurance and Accreditation Agency* (*ANECA*).

In Spain, ANECA has established a teaching performance assessment programme, DOCENTIA, in cooperation with all regional evaluation agencies. Participation is voluntary for universities. A university submits its plan for excellence in teaching to ANECA for certification. Assessment of the teaching staff based on the DOCENTIA programme plays a very important role in teachers' accreditation applications. The programme considers three dimensions in teaching: course design, development of teaching and results.

In Estonia, the Higher Education Strategy 2006-2015 includes several action lines focusing on the development of teaching skills. Thus, the transition to competence-based study programmes is supported by training for teaching staff, focussing on modern teaching and assessment methods.

The Estonian Ministry of Education and Research Primus programme (2008-2014) is supported by the European Social Fund. Primus has six major action lines, the most important one concentrating on the 'Improvement of teaching and supervising skills of teaching staff', providing training courses to enhance competences of academic teaching staff.

Excellence in teaching is one aim of the Slovenian National Higher Education Programme 2011-2020. To achieve teaching excellence, the Programme requires higher education institutions to develop activities of continuing pedagogical training and to provide support for their teaching staff. Mechanisms for promoting excellence in teaching shall include the development of centres for teaching competences.

In Norway, the Ministry of Education and Research is funding a pilot project at the University of Oslo, in cooperation with University of Tromsø: Norway's first Centre for Excellence in Education, following the model of centres of excellence in research. The goal of the centre is to develop new knowledge about teaching, learning and research in teacher education.

In the UK, the Higher Education Academy, in cooperation with British universities, has defined professional standards that support academic teachers in providing a high level learning experience to their students, using a range of different methods and formats. In particular it has developed the 'UK Professional Standards Framework for teaching and supporting learning in higher education' which, 'fosters creative and innovative approaches to teaching and learning'.

What makes good teaching and a good teacher?

Citizens of European countries have a significant collective interest in the quality of the higher educa-tion system in their countries. On the other hand, each individual student has a great interest in the qual-ity of their higher education. A graduate student who has attended high-quality teaching will have a good chance of being adaptable, confident, creative, innovative, entrepreneurial-minded and employ-able in the broadest sense of the term. A student who had poor or mediocre teaching has wasted a lot of his or her time and money and in a competitive job market is at a disadvantage. In many cases,

poor teaching also directly discourages students from staying in higher education and contributes to the high dropout rates and lack of student achievement we see in many countries.

Good teaching means that teachers produce modern and quality material for their classes. The teacher's knowledge base should not be limited to his or her subject, but must also include an understanding of learning theories, such as adult learning theory, self-directed learning and self-efficacy, and how to incorporate them into practice. Teachers need to be aware that different types of teaching methods and educational settings can produce different types of learning. They should also be able to face rapidly changing demands, which imply new sets of competencies and new approaches to teaching and learning. They should also be able to stimulate open and flexible learning that will improve learning outcomes, assessment and recognition.

The "Dublin Descriptors" were adopted in 2001 as cycle descriptors for the qualifications framework of the European Higher Education Area. These are generic statements about the achievements and abilities that students will acquire at the end of each Bologna cycle: knowledge and understanding, application of knowledge and understanding, making judgments, communication skills and learning skills. Teaching in higher education that focuses only on the first question, i.e. knowledge and understanding, misses the opportunity to help students to deepen their learning. Thus, teachers should be able to plan and deliver coherent learning that accelerates progress, deepens understanding and knowledge, and develops a range of skills and "learning behaviors," such as problem solving, interaction with teachers and other students, self-correction, critical reflections, improving competencies, experiential learning and more.

Achievement in all subjects should be guided by learning outcomes. Although the approach through learning outcomes is already the basis of the European Qualifications Framework and national qualifications frameworks, this basic shift has not yet been fully permeated through teaching and assessment. Institutions at all levels of education and training still need to adapt in order to increase the relevance and quality of their educational services, ensure their better accessibility and facilitate the transition be-tween different education and training pathways.

Quality teaching and learning have broad horizons, taking place in a research-rich environment, where the subject matter is guided by the latest knowledge and research, delivered in a way that encourages students to develop academic literacy and both subject specific and generic skills that can be directly applied in the real world, especially in the labor market. There is no contradiction between the impe-rative of good teaching and the imperative of research that criticizes, refines, discards and advances human knowledge and understanding. Good teaching, in many scientific and educational fields, is only good to the extent that it is informed by the latest research. A good teacher, like a good graduate, is also an active student, questioner and critical thinker. A good teacher aims to help the student be confident in handling the subject as it has been developed so far, to be brave in openness to new ideas, curious enough to look for new solutions and opportunities and insightful enough to work well with others. The student should also accept the fact that learning is a lifelong phenomenon that requires lifelong curiosity and commitment.

Universities and higher education institutions, as part of the education system, should not educate students only in narrow, knowledge-based specializations, but must go further, seeking the integral education of the person. They should consider offering students transversal courses or areas of

specialization. In this perspective, students will realize that they must acquire broader knowledge and skills. Higher education should help students build a wider base on which thez can build their future professional competencies. Rapid changes in technology, and in general in the way we work, make hard skills quickly obsolete. Learning to learn, one of the seven competences of the European Key Competences Framework, is essential. Efforts should focus on developing transversal or soft skills, such as the ability to think critically, take initiative, solve problems, and work collaboratively, which will prepare individuals for today's diverse and unpredictable career paths.

An excellent teacher can improve creative skills and learning outcomes such as:

complex thinking – problem solving, reciprocal learning, experiential learning;

social skills and participatory learning – interaction with teachers and other students, active participation in learning, interdependence; and

personal shaping of knowledge – progressive mastery, individual pace of progress, self-correction, critical reflection, active seeking of meaning, strengthened self-direction, internal drive/motivation.

In order to develop these skills, teaching is not enough: an appropriate environment is also needed. For example, extracurricular activities, whether organized at a university/college/institute environment or not, ranging from volunteering, culture and the arts, to sports and leisure activities, help develop soft skills and nurture talent.

The benefits of focusing and insisting on quality teaching will be felt widely and quickly if they are effective. They will be felt in a complex way, from increased professional fulfillment and teacher satis-faction, to increased student satisfaction and retention in studies, to better transfer of knowledge and skills, more efficient use of resources, better learning outcomes, etc. The sum of parts will be used for more confident, competitive and creative energy in the higher education sector, where each institution gives its best, in accordance with its competencies and conditions..

Students as partners in the teaching and learning process

Today, there is a far-reaching (at least rhetorical) consensus that higher education should put the student at the center, defining clear learning outcomes for different programs, courses and modules, and attaching particular importance to counselling, monitoring and interactive teaching methods. There is also a consensus on the development of assessment formats that take into account not only factual knowledge, but also further reaching competencies such as analytical capacity, critical thinking, communication and teamwork, and intercultural skills.

A greater emphasis on the teacher as a professional educator must be accompanied by other profound changes in the design and delivery of programs to create productive learning environments. Teaching and learning must become a team activity across disciplines, but also within them. Quality programs are designed, and student performance is assessed, on the basis of agreed learning outcomes, as a team product of all those involved in their implementation, rather than being simply an accumulation delivered and evaluated independently from one another. Effective student-centered learning means that the student must also be part of a team. The notion of student-centered learning has existed for many years, but many teachers and students still do not understand its implications. As far as students are concerned, not everyone is still ready for this challenge, nor are they all driven by the

desire to understand and apply knowledge, but very often aspire only to go through the course, often learn only procedurally to achieve the highest possible grades and as soon as possible moved on to the next subject. Still, not everyone understands that they need to deal with new issues that are bigger than the course itself, that are relevant to their lives and that cause live participation far more than just going through assessment or exams. It is still not widely understood, or at least not applied, that student-centered learning means that the role of the teacher should shift from knowledge transfer to guiding the student in his or her own learning.

Research on human learning tells us that the acquisition and application of knowledge are basically social acts: social interaction is a key component of learning. For example, practitioners learn best from observation and interaction with other skilled practitioners. But formal learning too often discourages social interaction. The Bologna reforms, which introduced a two tier bachelor-master structure, which is a novelty for many countries in continental Europe, provided an opportunity to significantly restructure curricula and put students and their learning experiences at the center. Such an opportunity has not always (or at least not yet) been used. Students are still widely seen as passive recipients of knowledge that professors choose to share with them under conditions set by individual professors, without much internal discussion by the faculty team outside of class schedules and exams.

It is still an exception that students are intentionally and explicitly authorized by their teachers (and by the higher education institution in a broader sense) to manage their own learning. But new methods in teaching and learning are being developed at more and more higher education institutions. Examples that have proven successful are cooperative teaching and learning methods, as well as problem-based learning, exposing teachers and students to real-life situations, challenges and cases.

The most advanced higher education institutions understand the design of the curriculum as sophistica-ted, joint teaching of all teachers involved in the implementation of a particular program, as well as stu-dents, graduates and labor market representatives. Defining the right learning outcomes and competencies, identifying learning activities that will enable students to achieve those outcomes, checking that the study program is realistic and manageable in terms of workload, and gradual updating and improvement of the program can be done only with constant dialogue involving all stakeholders sides. Some organize programs with a first semester or year common to all students, offering a choice of topics rang-ing from science to humanities. This gives students time to choose the right subject and at the same time confronts them with "big questions" that interest them.

Exams and grades remain a key part of the student experience. The shift in teaching towards learning outcomes and competencies must be accompanied by a change in assessment procedures: the taught facts and knowledge must no longer be simply checked, but the measures of competence that the student has acquired as a result of the learning process. In some cases, this may require new formats, such as role plays or simulated situations that anticipate what the graduate may encounter later in the labor market. Institutions need to define comprehensive standards not only for teaching purposes, but also for these innovative forms of assessment.

Some higher education institutions have begun to require prospective students to undergo selfassessments regarding their prior knowledge and affinity to certain subjects. In order to ease the transition from school to university, some higher education institutions organize summer schools and preparatory courses in order to better inform future students about the various choices and the choice

that suits them best. The benefits in terms of better preparation, wiser choice, student retention, and student satisfaction are self-evident.

Equally important is the active involvement of students in the development of counselling, guidance and mentoring systems. These systems lead to well-informed student choices and better retention rates, especially in the early stages of study for students of non-traditional backgrounds. Leading and advising students should support students on their path to successful graduation, strengthen their identification with the higher education institution and help students develop their individual and transversal competencies.

Often students are the first to notice whether the teaching is good or not. However, the question arises as to how much the institution is willing to routinely listen to students' observations in an atmosphere that sincerely welcomes such feedback or comments? On the other hand, in how many institutions are students more likely to feel like undesirable complainants whose point of view may be questionable? Asking students for feedback on their experience at the end of the semester has become common practice in many countries, but it is not always obvious that their attitudes have any real impact or lead to desirable changes. Higher education institutions should create an environment consisting of feedback mechanisms and systems that allow students' attitudes, learning experiences and performance to be taken into account. Robust institutional data is needed at the level of entry and advancement, and after completion of studies to monitor, evaluate and improve teaching and learning practices. Based on these data, higher education institutions can face the obvious problems of certain courses and programs and work together with responsible teaching staff and students to improve the situation.

A still underdeveloped area of higher education in Europe is the monitoring of students during their studies and after graduation. It is of interest for the higher education sector to know how students made their way through their academic careers and where graduates managed to enter the labor market, how they passed in employment and in broader aspects of rounded human life. These are the ultimate checks on the quality of education in the institution and extend far beyond fund-raising alumni networks and the like, which can often seem to serve the economic interests of the institution more than the interests of graduates.

One of the main changes of the last decades is the massive internationalization, and even the globalization of science, economy and politics. Such development is likely to continue, accelerate and expand into more sectors of our public and private life, predominantly in the labor market, driven not only by the exponential growth of world trade, global capital investment and human mobility, but even more so by new media. This will not only affect the content of traditional subjects, but will change the ways of delivery and receipt.

HLG believes that, despite all the uncertainties before us, there are two obvious consequences and educational requirements arising from globalization. First, our graduates must be competitive not only in the local or national, or even European, but also in an increasingly global market. Second, to save our "global village" from imploding under growing tensions and competition, our graduates as future leaders need a new kind of intercultural understanding, respect for common rules and fair play, understanding of different interests, views and ways of thinking, and the ability to reconcile and compromise.

In short, global competitiveness and global cooperation are the basic goals of teaching and learning, which aim to enable students for a peaceful and healthy life in the 21st century. For our higher education institutions, this means that "internationalization", which has long been considered a "luxury accessory", must be moved to the very center of university or faculty strategy and development. At the same time, the definition of "internationalization", which has often been limited to the recruitment of international students, must be extended to a new holistic approach, where its impact on the overall quality of programs and graduates is reflected in globally related and intercultural learning outcomes. In practice, this means the mobility of students and staff (incoming and outgoing), the international dimension of curricula, the internationalization of campuses, a positive and efficient approach to foreign language learning, the transnational delivery of courses and degrees (offshore branches, distance education, MOOCs), international networks, alliances and partnerships and so on. This should be included in order to form an explicit "strategy of internationalization" of universities and faculties, which in turn must be an integral part of the overall mission and strategy of an individual higher education institution.

HLG recommendations:

Higher education institutions should encourage, welcome, and take account of student feedback which could detect problems in the teaching and learning environment early on and lead to faster, more effective improvements.

Curricula should be developed and monitored through dialogue and partnerships among teaching staff, students, graduates and labour market actors, drawing on new methods of teaching and learning, so that students acquire relevant skills that enhance their employability.

Student performance in learning activities should be assessed against clear and agreed learning outcomes, developed in partnership by all faculty members involved in their delivery.

Higher education institutions and national policy makers in partnership with students should establish counselling, guidance, mentoring and tracking systems to support students into higher education, and on their way to graduation and beyond.

Higher education institutions should introduce and promote cross-, trans- and interdisciplinary approaches to teaching and learning, helping students develop their breadth of understanding and entrepreneurial and innovative mind-sets.

Higher education institutions should develop and implement holistic internationalisation strategies as an integral part of their overall mission and functions. Increased mobility of student and staff, international dimension of curricula, international experience of faculty, with a sufficient command of English and a second foreign language and intercultural competences, transnational delivery of courses and degrees, and international alliances should become indispensable components of higher education in Europe and beyond.

Examples of good practice:

Maastricht University has introduced student centred and problem based learning (PBL) in all faculties. The core elements of PBL are studentcentred, small groups, interactive and case based. The students are in charge of the learning process. PBL is characterized by learning by doing, learning by teaching peers, activation of prior knowledge, and intrinsic motivation.

Humboldt University in Berlin created a bologna.lab that develops new modes of research based, student-centred teaching. Law students, for example, already work at bachelor level with law firms in Berlin on real cases in cooperation with the professors at the law school.

The European Universtity Association 'Track it' project has surveyed tracking initiatives of students and graduates in Europe, and provides guidelines for higher education institutions which intend to develop or enhance tracking.

Officially launched in September 2010, Aalto University merges three major Helsinki universities in technology, art and design, and economics. Aalto University's mission is a shift toward multidisciplinary teaching and learning, while placing a strong overall focus on technology. The university integrated technology, business and design to groom graduates for success in a world transformed by technology, information overload, and global competition.

Institutional and government support

Above-average teaching engagement is still largely left to individual teachers who have little or no insti-tutional support. The management of higher education institutions often does not define teaching and learning as a joint endeavor of all teachers and students that requires a holistic quality management. As a result, there is often no exchange of views on these issues in the institution, and the institution misses an important opportunity to improve its performance and sharpen its profile.

The higher education institution needs to support its teaching staff through various measures, ranging from continuing education and training offers to individual mentoring and coaching, and measures that strengthen the cooperation among the team of teachers, especially in the design, development and deli-very of curricula and in the assessment of student performance. The senior management should spread the message that effective, learning-oriented teaching is expected from all staff (not just enthusiasts) and to promote this message systematically, clearly linking it to institutional priorities. HLG also insists that higher education institutions should ensure that there is manifest and actual parity of respect for teaching and research in their essential identity and culture, expressed in systems of rewards, incen-tives, promotions and priorities. Higher education institutions should define their teaching and learning objectives in the context of their study programs, including how they should be conducted and evaluated. This can be a starting point for the development of a quality management scheme that includes the entire institution, from the governing body to teachers, students and the administration.

The question is why should a professor devote an important part of his or her time and energy to improv-ing students' learning experiences when the constant reputation gap between research and teaching and the lack of institutional support are the main disincentives for developing a quality teaching and learning culture? Career and salary structures in most national higher education systems do not yet provide a bonus for outstanding teaching engagement. Most international university rankings are largely biased towards citation indices of research publications that are easier to count, rather than looking at the broader university mission in areas that are fundamental, such as teaching and learning, that are less susceptible to such counting. Good teaching, unlike good research, does not lead to easily verifiable and measurable results, but consists rather in a processes. Making it visible, and thus improving its reputation and providing incentives to its protagonists, requires additional effort on behalf of

governments and higher education institutions. A system of incentives and rewards is needed that takes into account the diversity of teacher types and teaching styles.

A special incentive comes from the awards given to professors for their outstanding performance in teaching. There is a wide range of such awards in the EU today. Some of them are offered at the institutional or even departmental level and range from unpaid recognition and promotion to financial prizes. Others are sponsored by governments or private donors, linking high visibility to significant financial rewards. Recognitions and awards initiated by students have proven to be very successful. Awards can be a good starting point and can serve as a on-going reminder of the value of teaching, highlighting good practice and recognizing exemplary, inspiring teachers, or a way to draw attention to ground breaking research on quality of teaching and learning. Such public recognition can help attract the posi-tive attention that quality teaching currently needs and lacks, both within academia and the general public. But individual awards by their nature cannot replace the necessary long-term systematic training of teaching staff as professional teachers. However, they can help, especially for countries at the starting point of promoting quality in teaching and learning. Recognitions and awards for excellent teaching have proven to be a sustainable tool for raising awareness on this issue in higher education institutions and in creating national policies, as the first element in a series of initiatives leading to the development of institutional programs for teaching quality, as well as institutional and national strategies.

Given the financial constraints under which most European higher education institutions operate, it can often be difficult to initiate a process of institutional review and action aimed at good teaching and learning. Higher education institutions should not be left alone with the burden of developing a culture of good teaching and learning. In some countries, public and/or private funders provide support to this end. The scope and resources available to achieve this goal may vary from institution to institution and from state to state. Expectations regarding what is achievable can also vary widely. However, in every institution and state, the inevitable truth is that it will be extremely useful if you start from somewhere, and the sooner the better.

The organization of education and curriculum design are the responsibility of Member States and individual higher education institutions. They are connected in a complex way with the culture and history of individual peoples and are essential for defining national identities. Each country's education systems are also decisive factors in both the sustainability of a nation's democratic system and a country's competitiveness in the global economy. Within Europe, a country's educational performance inevitably affects the economic and social potential of its partners. Therefore, the European Union has a duty to help public authorities and education stakeholders in different countries to improve the efficiency of their systems.

The European Union has a long history of providing such support. For over 25 years, the Erasmus pro-gram has provided space for higher education institutions to work together, learn from each other, devel-op new curricula and agree on new ways to approach program design. New pedagogical tools have been introduced, such as the European Credit Transfer and Accumulation System (ECTS), which have revolutionized the way of learning, is built and recognized across borders. Countries have used the European Social Fund to train higher education staff for new pedagogical tools and techniques and to introduce transdisciplinary approaches.

The European Union's multiannual financial framework provides even stronger opportunities to support the modernization of the higher education system. The increased level of funding for education and research programs and the new European Social Fund should be used by public authorities and stakeholders to invest in the quality of their teaching and learning. The European Education and Training Program proposes two key actions of particular interest in this area: strategic partnerships and policy support. Strategic partnerships support structured and long-term cooperation between higher education institutions and key actors, such as public authorities and enterprises, focusing on reform issues such as the quality of teaching and learning. HLG believes that at the European level it is necessary to invest in the development of new pedagogies that are better adapted to the needs of a wider diversity of students and that enable them to respond effectively to changes in the labor market and society. Collective actions, involving partners from many EU Member States and beyond, can help to extract the most positive experiences and enable them to adapt to local needs.

Preporuke HLG:

Public authorities responsible for higher education should ensure the existence of a sustainable, well-funded framework to support higher education institutions' efforts to improve the quality of teaching and learning.

Heads of institutions and institutional leaders should recognise and reward (e.g. through fellowships or awards) higher education teachers who make a significant contribution to improving the quality of teaching and learning, whether through their practice, or through their research into teaching and learning.

The European Union should support the establishment of a European Academy for Teaching and Learning led by stakeholders, and inspired by the good practices reflected in the HLG report.

Member States, in partnership with the regions, are encouraged to prioritise, in their Partnership Agreements under the Structural Funds, initiatives to support the development of pedagogical skills, the design and implementation of programmes relevant to social and labour market needs, and the strengthening of partnerships between higher education, business and the research sector.

The European Union should support the implementation of these recommendations, in particular through promoting: innovative teaching and learning methodologies and pedagogical approaches; guidance, counselling and coaching methods; improved programme design, taking account of the latest research on human learning; the professionalization and development of teachers, trainers and staff; mobility and exchanges of academic staff for long term teaching assignments; and systematic and regular data collection on issues affecting the quality of teaching and learning.

Examples of good practice:

The Central European University, Budapest, initiated its European Award for Excellence in Teaching in the Social Sciences and Humanities to draw attention to the importance of teaching excellence in higher education, and to promote a better balance between the focus on research and that on teaching. Their Centre for Teaching and Learning focuses on opportunities for doctoral students to develop as teachers, collaboration schemes with faculties that promote excellence in teaching and mentoring, and integrating blended learning into courses and seminars.

In the UK, the annual National Teaching Fellowship Scheme of the Higher Education Academy holds awards to recognise excellence in individuals, intended for their professional development in teaching and learning or aspects of pedagogy.

The Norwegian Ministry of Education and Research awards an annual price for excellence in education. Higher education institutions present what they consider to be best practice in teaching and study programmes, a jury of researchers and professors assesses them, and the Ministry of Education and Research awards the prize of NOK 1 million, about EUR 130 000.

The National Academy for Integration of Research, Teaching and Learning (NAIRTL) in Ireland gives out five annual awards of EUR 5 000 each to individuals or groups. The awards recognise and celebrate teachers of undergraduate and postgraduate students who have demonstrated excellence and commitment to integrating their research with their teaching.

In Germany, the German Rectors' Conference and the Stifterverband für die Deutsche Wissenschaft have been awarding an annual Ars legendi Prize for excellence in higher education teaching since 2006. With EUR 50 000, the prize is meant to act as a counterweight to the many research prizes and highlights the particular importance of excellent teaching.

The Fellowships in Teaching and Academic Development at University College Dublin are part of an institutional development structure to encourage a greater number of staff to focus on advancing university-wide enhancement in teaching and learning. The fellowships offer a mechanism to reward individuals for these contributions. The fellowship scheme aims to identify and develop key academic staff with both the pedagogic expertise and the leadership capacity to effect transformational change in teaching, learning and assessment practices both in discipline-specific areas and thematically, across the institution.

Linnaeus University in Sweden adopted an overall strategy for providing a highly attractive learning environment: Linnaeus University – a journey into the future. The university strives to reach its goals through three main tools: a recruitment policy that takes into account the applicants' teaching skills, an action plan for developing the pedagogical skills of the existing staff, and guidelines for salary negotiations addressing teaching performance as one important criterion.

New modes of teaching and learning

Technology and new pedagogical tools

Worldwide demand for higher education is expected to grow exponentially from 100 million students to over 250 million by 2051. Emerging economies such as China and India will be particularly at the forefront of this growth. However, even in the EU, where many countries are experiencing declining populations, higher education enrolments continue to increase. A significant portion of this growth will come from adults and returning learners – complex groups most of whom will study while working at the same time. These projections require well-planned action and ask a few questions. Will higher edu-cation institutions in Europe and beyond be able to maintain and improve the quality of learning by facing the continuous growth and diversity of the student population? How will institutions adapt to meet a wider range of needs? Will there be enough financial resources for this expansion of

higher education? There is a growing understanding that the development and integration of innovative ways of learning and teaching must be a key part of the answer to these questions, and that Europe must be a relevant player and partner in the actions to be taken.

The advent of digital technology in the last two decades has dramatically changed the world and will continue to do so. Technology is driving major changes in the professional and personal lives of people across Europe and the world, affecting all aspects of society and is now an integral part of the way most people communicate, work, learn and access knowledge and information. New and emerging techno-logies are already beginning to have a transformative effect on the provision of higher education. We are witnessing changes in the way we teach in higher education and in the way students learn. Although the conventional classroom setting will continue to form the basis of the higher education system, it will be improved by the integration of new tools and pedagogies, and will be complemented by many new online learning opportunities and more diverse higher education service providers.

New technologies and approaches to education already have a clear and positive impact on the provision of higher education services. They can support efforts under the Bologna Process and the European Union's Modernization Agenda to enhance the quality and extend the reach of higher education across Europe, and already enable better learning and teaching both in the classroom and online, as educational resources from around the world they are becoming freer and more and more interactive learning media are being used. Teaching methods can be better adapted to the needs of individual students, and advances in learning analytics are enabling quicker feedback on student performance.

There is huge potential for expanding access to higher education and increasing the diversity of the stu-dent population. Internet technologies provide opportunities to learn anywhere, anytime and from anyone. This flexibility is essential for non-traditional students and will enable a change in the engagement of higher education institutions in lifelong learning and continuous professional development. This will provide an important tool for governments in ensuring the diversity of services in higher education sys-tems to meet the needs of all students. It also provides a platform to reach international markets and complements existing advances in cross-border education.

Finally, new technologies can facilitate greater collaboration, both with global partners and at the local level. The development of educational partnerships is an important element of the European strategy for cooperation with other parts of the world, and also provides a mechanism for increasing the rate of education in developing economies. At the local level, technologies can support national efforts to encourage greater collaboration between institutions, combining expertise and providing greater critical mass.

The benefits are clear and Europe must take joint action to ensure that the potential is fully exploited. Although the phenomenon of MOOC has recently dominated the discussions on digital learning, the impact of technology can be and will be much wider. Governments must strongly encourage and support greater integration of new technologies and appropriate pedagogical approaches into conventional edu-cational offerings. Traditional service providers need to offer more diverse services and provide more online courses, with a particular focus on continuing professional development and lifelong learning. They should also be encouraged to engage in newer forms of open online which are increasingly being established. The tendency towards openness and freely available

educational resources needs to be maintained and upgraded. The goal should be to ensure that all publicly funded educational resources are openly available.

Achieving these ambitions is not an easy task. This will require significant changes in the way higher education institutions work, as well as a change in the culture and way of thinking. Challenges will re-quire targeted action and support. There is still a culture of conservatism in European higher education that needs to be changed, which requires strong leadership and vision from both public authorities and institutional leaders. Although a wide range of good practices is already emerging across Europe, this is largely happening in an uncoordinated bottom-up approach. Governments and institutions need to develop comprehensive strategies at the national and institutional levels to adopt new ways of learning and teaching within higher education. Governments need to decide on the combination of services necessary in the system to meet the needs of all students and must identify the support needed to achieve this. In particular, targeted financial incentives will be most important in start-up initiatives. The teaching staff is, of course, at the forefront of implementing these changes and they must be equipped with the skills and knowledge necessary to take full advantage of the wide range of new teaching tools available. Continuous professional development of teachers must become the norm of all European institutions.

New service delivery models bring certain challenges. But given the opportunities they offer for lifelong learning, continuing professional development and internationalization, it is imperative that public authorities consider how these learning opportunities can be more fully introduced into the higher education system. There are many concerns about the quality and wider acceptance of these learning experiences and action is needed to address these concerns. Guidelines on quality assurance and the development of credit facilities and the recognition of these forms of learning will advance efforts to incorporate them as a credible alternative to the traditional study program. The ECTS system gives Europe a clear advantage in this regard. Online learning has brought with it the ability to collect and analyze data on students, which was not possible before. This also creates great potential for personalized learning, although care must be taken to ensure that students are fully aware and give full consent to the collection and use of their personal data.

HLG distinguishes three main models of using new ways of learning and teaching:

Conventional higher education service providers offering on-campus programs and courses using online technologies and pedagogies, an approach known as blended learning. This also applies to conventional distance education providers.

Conventional higher education service providers that offer complete online programs or short online courses. These courses and programs may be limited to enrolled students or those not enrolled, with or without credit. This model has a special potential for lifelong learning and transitional education.

Non-university service providers that offer courses free of charge or for a fee, with or without credit.

New modes of learning and teaching in the modernisation of higher education

Digital technologies in themselves do not necessarily improve the quality of learning and teaching. Of course, the quality of the content must remain paramount. However, digital technologies

create the con-ditions for such improvement and can pave the way for more student-centered teaching. Teachers now have the opportunity to rely on a wide range of materials in different formats that can improve the qual-ity and diversity of the curriculum. Quality improvement is the result of common high-quality learning materials and more creative and individualized pedagogical approaches.

Students are unique, and so is the way they learn. Therefore, the teaching tools used at universities and faculties should suit individual ways of learning, and the student would be at the center of that. Some of our students will learn better and faster with the help of interactive media that include images, graphics, videos and audio elements. Others will prefer static text and numbers in different measures. Classroom technology can combine all of this for a personalized learning experience for each student, depending on his or her individual abilities. In addition to improving learning efficiency, such adaptation to individual needs can also have a significant effect on reducing dropouts.

New technologies and communication platforms also enable greater interactivity between teachers and students and between students both inside and outside the classroom. Although much of the program content can be delivered through "self-administered" e-learning, teachers can concentrate on their role as mentors, developing with students the skills of information management, understanding and questioning, critical thinking, and knowledge application. Thus, digital media can facilitate more active problem-based learning, which has been shown to encourage greater student engagement and lead to better learning outcomes. Digital assessment tools can provide quick feedback on student progress in order to tailor the curriculum to student needs. The potential of technology is also to turn from a mere transfer of knowledge to a partnership in learning.

The traditional provision of higher education has never served all groups in society. Although entry into higher education has increased significantly in recent decades, constraints on money, time, and location continue to prevent many people from participating in higher education. Such is the case with adults and those who are continuously educated. Ambitions to become a knowledge-intensive society and economy depend on the availability of a highly skilled, flexible workforce. There is an urgent need to provide opportunities for training, retraining and continuous professional development to ensure that as many citizens as possible have the skills and attributes required by the labor market today, and more importantly tomorrow. Governments will want their higher education institutions to become much more active providers of this type of education. This will require changes in their work to meet the needs of this type of student. Digital technologies and the provision of online services provide the means to do so.

In traditional classroom settings, it is difficult for a teacher to track the progress of each student. The pace of the course is impossible to adjust to individual needs. Online services allow the collection of data that can be used to track student progress. Advances in big data and learning analytics can help our higher education system adapt teaching tools and develop more personalized learning pathways based on student data. However, the collection, analysis and use of learning data may only take place with the explicit consent of the student. Data can include how students participate in the course, communicate with other students, and adopt concepts over time. Information on the learning process can be provided as opposed to information only on the learning outcome. Teachers can experiment with different approaches and examine immediate impact. The data can also be used to identify at-risk students at an early stage, helping in efforts to reduce dropout rates. Although the field is still relatively young, exciting developments in learning analysis are underway. Several universities in the United

States have provided teachers with the opportunity to follow their students' performances live. The high availability and usability of data also has great potential for empirical research on learning and teaching. Stanford's Analytics Laboratory is one example that applies empirical research to better understand student performance. The learning process and feedback tools are another advancement that allows students to monitor their own performance and adjust it accordingly. Carnegie Melon University Open Learning Initiative and the University of Maryland's Check-Mi-Activities-Tool are two examples of such promising.

Digital skills for learning and teaching

Ensuring that all employees in higher education institutions have the skills and attributes necessary for the successful use of new technologies, their incorporation in the course, will be crucial for the successful inclusion of new ways of learning and teaching in conventional study programs and expanding online learning opportunities. A wide range of tools, programs, technologies and sources of information can also make it difficult for teachers, who will not know where to start. New technologies and associated pedagogy require a significantly different set of skills compared to conventional teaching, and this can create additional pressure on teachers. Not all technological experts are among the academic staff and in many cases they have not passed any form of pedagogical training at all. They need specific training, guidance and support if they want to provide quality teaching. This is particularly important because the integration of these new teaching methods results in a changing role for teachers, from knowledge transmitters and subject matter experts to mentors and someone who facilitates critical thinking. In the first part of this text, we talked about the need for certified pedagogical training for all teachers and the introduction of mandatory continuous professional development. Digital skills must be an essential element of this.

Institutions must also provide digital skills training for students, especially first-year students. In many cases, it has been shown that students are not sufficiently prepared in their previous education for digital learning. Recent research has shown that in all but one EU country, over a half of students do not use ICT for projects or teaching. This further confirms the findings in the European Commission Communication on the opening of education. If students do not get these skills in schools, they have to get it in higher education. This goes beyond improving students' learning experiences; it is about acquiring skills that are essential in the labor market and, increasingly, for everyday life. Institutions must also be aware of the need to repeat the skills acquired during the campus learning experience in online work. Networking and peer interaction is an important element of the learning experience, and online platforms must become an integral support for students on the net.

The role of higher education institutions and governments

Europe is slowly embracing the potential of higher education offered by new ways of learning and teaching. Although pockets of innovative activity are emerging, there generally remains a certain level of conservatism and a lack of leadership and vision in Member States at both the national and institutional levels. Too often, these new developments are viewed as small-scale experiments or as optional additions to the normal operation of higher education institutions. There is still a widespread belief that out-of-classroom service delivery is inferior to conventional programs. Teachers and students feel more comfortable in the classroom and more traditional teaching styles are closer to them. As noted

in the NMC Horizon report, ubiquitous aversion to change limits the diffusion of new ideas and too often discourages experimentation.

Although the school sector in various European countries has taken various actions and initiatives re-lated to online learning, national authorities have so far been reluctant to get involved in these issues in the higher education sector. While accepting that pedagogy and curriculum design are a matter of institutions, governments are responsible for defining policies, legal frameworks, and funding frameworks that have a direct impact on the motivation and ability of institutions to integrate new ways of providing higher education. However, comprehensive national strategies are clearly lacking in the vast majority of European countries. This is simply not good enough because it exhibits inertia and a lack of ambition, for which future generations will not thank any of us. Policy-makers need to shift into a higher gear.

Developing a national vision of how new ways of learning and teaching will be used to support higher education policy goals is essentially the first step in achieving the changes needed across Europe. This process will provide an opportunity for dialogue with all stakeholders and will outline a profile of new developments and give them impetus. Strategies should provide a clear picture of the diversity of services expected to be provided in the system (in the classroom, at a distance, online, short-type provision, etc.), provide support for the improvement of conventional services using ICT, and should also address issues related to newer forms of service delivery (eg MOOCs) and new types of service providers outside higher education. National strategies should identify the necessary national support structures needed to facilitate funding, infrastructure development and training, and should adopt policies on important aspects of the issue, such as quality assurance, credit and recognition, open access and copyright. Authorities should not prescribe too much or try to "pick winners", but their goal should be to develop conditions that encourage and embrace innovation and create real momentum.

National frameworks will provide a blueprint for institutional action. Similar to the national level, there are currently not many cases where European higher education institutions have adopted a strategic in-stitution-wide approach to integrating new ways of learning and teaching into their educational programs. In general, initiatives are usually developed in an ad-hoc manner and by individuals among teaching staff who are interested in using new technologies and pedagogy. In many cases, staff are not aware of the options available. Although the EUA research on institutions reported that half of the institutions interviewed have an e-learning strategy, only a quarter make extensive use of e-learning across the institution. According to the same survey, only 12% of institutions have MOOCs. Even more interesting is the reaction to MOOCs with 42% reporting mixed feelings, 30% claiming to have limited knowledge or disinterest in MOOCs, and only 10% positive about MOOCs.

Strategic vision and leadership are needed to seriously address these perceptions and to more fully engage staff to address the potential offered by new ways of learning and teaching. The integration of new technologies and pedagogy should be placed at the center of institutional strategies on teaching and learning and they should become an integral component of the day-to-day operations of the institution. The leadership of the institutions must consistently express the expectation that the entire teaching staff will have to become more active, skilled and experienced in using new, innovative pedagogical tools and provide the support needed to meet these expectations. Institutional strategies should establish a coherent framework for developing new modes of delivery as part of the institution's

work, incorporating innovative technologies and pedagogy into curricula, and providing appropriate training for acade-mics and students.

Creating dedicated organizational structures is important to ensure that innovation is transmitted across the institution. Creating hubs or centers of excellence in digital learning can provide ongoing support, promotion and development of innovative approaches. By hiring learning technology specialists, ICT experts and educational programmers, the institutions will be provided with state-of-the-art expertise and support for academic staff throughout the institution. These staff must be considered as key actors in the development of digital capacities in the institution and should be involved in the planning and design of the program. These types of centralized structures can also ensure that a common institutional approach is taken to the challenging aspects of open and online services such as copyright, intellectual property and learning evaluation.

Institutions should also seek opportunities for cooperation with external partners. As already mentioned, there are a number of companies that now provide higher education services such as assessment and certification. These companies are developing innovative products that can complement the work of the institution and provide more efficient means to provide these services, allowing academics to concentrate more on curriculum design. There is also considerable scope for cooperation between institutions and across borders in designing digital learning strategies, infrastructure support and pedagogical training frameworks.

Current models of financing higher education and tuition regimes in many European countries do not promote the development of programs provided via the Internet and, in some cases, act as a barrier. This manifests itself in several ways. First, funding models in most countries are predominantly related to the number of "traditional" students in "traditional" courses. This means that the institution will not receive public funding in relation to a student attending an online course, which does not give it a finan-cial incentive to increase its online offer. This has always been a disincentive for already established ways of distance learning and flexible learning, and even for part-time studies. Increased use of forms of formal distance education, both at traditional universities and at open universities, e.g. fully online master programs, will further test these funding models. It should also be said that tuition regimes in some countries prevent the application of taxes in any circumstances. The inability to generate addition-nal revenue from online courses can diminish the enthusiasm of institutions to invest in the development of more diverse delivery options.

Giving incentives under major funding models may not be enough to create the levels of change that Europe needs. There is a widespread belief that online courses are an inexpensive form of service deliv-ery. There is also a complete underestimation of the efforts and costs involved in institutions in develop-ing their digital capacity and fully incorporating new technologies and pedagogies into the overall business – both within conventional services and in newer forms of online services. This requires specialized professional staff, training and professional development of the teaching staff, investment in infrastructure and, most importantly, significant time and effort of the teachers who teach the courses. Public authorities must recognize this and take measures to encourage action. Targeted funding can be an im-portant means of initiating activities. Some countries and higher education institutions are already moving in this direction by introducing targeted funding initiatives to support technological development, designing online courses and pedagogical training.

HLG recommendations:

The European Commission should support Member States in developing and implementing comprehensive national frameworks for diversifying provision and integrating new modes of learning and teaching across the higher education system. It should promote mutual learning on key aspects including skills development, infrastructures, legal frameworks, quality assurance, and funding, in particular by exploiting the potential of the Erasmus+ programme.

The European Commission should prioritise support to higher education institutions under the Erasmus+ programme to enhance digital capacity and mainstream new modes of learning and teaching within the institution. Erasmus+ funding should also be made available to promote experimental partnering with specialist service providers.

The integration of digital technologies and pedagogies should form an integral element of higher education institutions' strategies for teaching and learning. Clear goals and objectives should be defi ned and necessary organisational support structures (such as the European Academy of Teaching and Learning) established to drive implementation.

National authorities should facilitate the development of a national competency framework for digital skills. This should be integrated into national professional development frameworks for higher education teachers.

All staff teaching in higher education institutions should receive training in relevant digital techno-logies and pedagogies as part of initial training and continuous professional development.

National funding frameworks should create incentives, especially in the context of new forms of performance-based funding, for higher education institutions to open up education, develop more fl exible modes of delivery and diversify their student population.

National authorities should introduce dedicated funding to support efforts to integrate new modes of learning and teaching across higher education provision. Funding should encourage collaborative responses to infrastructural needs, pedagogical training and programme delivery.

National and regional authorities should utilise opportunities under the European Structural and Investment Funds programme to support the development of necessary supporting infrastructures, technologies and repositories.

Public authorities should develop guidelines for ensuring quality in open and online learning, and to promote excellence in the use of ICT in higher education provision.

The European Commission should support cross-border initiatives to develop quality standards for open and online learning under the Erasmus+ programme.

Higher education institutions should ensure that quality assurance arrangements apply to all forms of credit-awarding provision in the institution. Institutions should use the quality assurance system to monitor retention rates and inform the development of appropriate supports.

The European Commission and national authorities should encourage and incentivise higher education providers to award and recognise credits under the European Credit Transfer and Accumulation System for all forms of online courses. The current revision of the ECTS Guide should incorporate these principles.

Governments and higher education institutions should work towards full open access of educational resources. In public tenders open licences should be a mandatory condition, so that content can be altered, reproduced and used elsewhere.In publicly (co-)funded educational resources, the drive should be to make materials as widely available as possible.

European states should ensure that legal frameworks allow higher education institutions to collect and analyse learning data. The full and informed consent of students must be a requirement and the data should only be used for educational purposes.

Online platforms should inform users about their privacy and data protection policy in a clear and understandable way. Individuals should always have the choice to anonymise their data.

Examples of good practice:

Ireland, through the National Forum for the Enhancement of Teaching and Learning, is developing a national roadmap for building digital capacity in higher education. This will address strategy development, pedagogical and skills requirements, and technological supports. It will be underpinned by a dedicated fund for collaborative initiatives.

The German Forum for Higher Education in the Digital Age, initiated in 2014 and funded by the Federal Ministry, is an independent national platform for the promotion of digital learning and teaching in German universities. From innovation in teaching and learning to questions of governance and policies, six expert groups work on different subjects along the scope of e-learning, in order to discuss crucial questions, and develop benchmarks and a recommended course of action. The Forum particularly aims to increase the visibility of digital teaching and learning in public and to promote open discourse on the subject.

The Open Education Europa portal, established by the European Commission in September 2013, provides a pan-European gateway to free-to-use open educational resources. The materials available on the portal have grown dramatically since its launch and includes learning resources, courses and MOOCs.

UNESCO, in partnership with Cisco, Intel, ISTE and Microsoft, has developed an ICT Competency Framework for Teachers detailing the competencies that teachers need to integrate ICT into their practice and professional development. Although this is designed for secondary teachers, it has the potential to be tailored for higher education.

The University of Edinburgh Distance Learning Initiative is an inter-university strategy for the development of online distance learning courses. It includes investments of several million pounds. A large number of master and CPD accredited programs have been developed, and the goal is to reach an equal number of students online and on campus.

The Swiss Virtual Campus (SVC) programme was an eight year targeted initiative to promote e-learning at Swiss Higher Education Institutions. E-learning initiatives are now mainstreamed and related costs are integrated in the ordinary budget of HEIs.

eCampus is a five year programme, funded by the Norwegian Ministry of Education, focusing on making technology available for the Norwegian higher education sector to make their teaching and research better, more effective and more available across organisational and geographical barriers. One of the areas that eCampus focuses on is lecture capture.

Appendix: Higher Education in the Strategy for the development of education in Serbia

The strategy for the development of education in Serbia until 2020 was adopted in 2012. It deals with the development of education at all educational levels, and one of the chapters talks about the development of higher education. However, the topics covered in this text are very little discussed in the Strategy. In the section on the modernization of study programs and new types of teaching, it was said that the study programs should introduce elements of research, as well as content that encourages entrepreneurship, that practical skills and competencies should be improved, that in the implementation of exist-ing and development of new study programs new methods and information technologies should be introduced, and that the Government should support higher education institutions in the modernization, procurement and implementation of state-of-the-art software and hardware. It is also said that wider use of e-learning methodology and technologies should be supported as a supplement to traditional learning, through the development of study programs that run in parallel (in classical form and as distance learning) and study programs that are implemented only as distance learning, as well as that the quality stan-dards for distance learning should be harmonized with the practice in the world and the EU, especially taking into account the standard which defines the workload of teachers.

In the section dealing with increasing the efficiency of studying, one of the planned measures is to accel-erate study by modernizing teaching, which includes the application of active learning methods, the principle "student at the center of learning", continuous student work during the semester, development of creativity and entrepreneurship and personalized learning. However, nothing has been said about how this will be achieved. On the other hand, the chapter on modernizing the organization of academic studies also talks about increasing the competencies of university teachers by providing additional edu-cation and training of teachers in pedagogy. It is also said that in the selection rules for teachers, their research work and achieving results in teaching should be encouraged.

Analyzing the problems related to teaching competencies in higher education, it was pointed out that the same practice is still applied in the education of higher education teachers: neither training for the role of a teacher has been established nor systemically defined. The basic knowledge of the profession (contents) is significantly more valued than how that knowledge is transferred to others. At universities, within the implementation of the election/re-election of teachers, there are no real indicators for asses-sing the quality of teachers (except for the profession, which is expressed in the number of scientific/ professional papers). The minimal criteria for the elections include precisely defined indicators of scientific or artistic work, while educational work is not evaluated at all. It is now either assessed through insufficiently relevant indicators such as student surveys, or there is a complete lack of objective indicators for assessing the quality of teaching methods.

In the part that talks about the measures and actions that will be taken, it is said that for the initial formation of teachers for higher education, university centers for the development of education will be established. In these centers, standards of competencies and professional development of university teachers will be developed and applied as a realistically achievable professional portrait of the higher education teacher of the future, with the definition of special quality indicators. Teachers in higher edu-cation will acquire pedagogical competencies at the latest by entering the first teaching title. This will be regulated by the law on higher education. The statutes of higher education institutions will

include provisions on that, as well as, for the selection and promotion of teachers, the measures and criteria for determining pedagogical competencies. The Strategy also says that teachers in higher education should be systemically obliged to additional education in pedagogical-psychological-methodological areas, connecting teachers' progress with professional teaching competencies (and not only with scientific and professional ones, as before). University Centers for the advancement of teaching and learning, which are planned to be established at integrated universities and larger universities, should also perform this function for smaller (and private) universities and vocational colleges. Universities should make a commitment to raise the quality of their teachers. This will be achieved by introducing additional criteria for re-election related to teacher work and defining indicators that will measure the pedagogical work of university teachers. Only after that it can be expected that the university will make progress in changing the (current) approach to the professional development of university teachers.

Unfortunately, none of the planned has been realized so far.

The strategy in question ceased to be valid in 2020, and a new strategy, for the period until 2030, has not been adopted yet. The draft of the Strategy for the Development of Education in Serbia until 2030 can be found on the website of the Ministry of Education, Science and Technological Development of the Republic of Serbia. Unfortunately, even this draft offers nothing more than the strategy for the previ-ous period.

The digitalization of higher education is stated as a special goal in the draft, which means the introduction of digital platforms, electronic index and electronic student register, as well as the development of the register of competencies and the register of qualifications. As for digital platforms, nothing is said precisely about what they would serve. Given that all other proposed innovations relate to higher educa-tion administration, it can be rightly assumed that even these digital platforms will have nothing to do with teaching and learning.

Regarding human resources in higher education, the draft plans as a first step to define quantitative and qualitative indicators for assessing teacher competencies in higher education institutions, which should become part of the Framework of Teacher Competences in Higher Education. After that, a new concept of the system of continuous professional development of teaching, administrative and technical staff at higher education institutions will be created, quantitative and qualitative indicators will be defined for assessing the effects of professional development and new criteria and procedures for selection and promotion of teaching staff at higher education institutions will be defined. All these changes will be accompanied by changes in regulations.

We can only hope that at least this little that is planned will be realized.

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Questions:

What is a textbook in the 21st century?

How students use a textbook?

What is needed for a good textbook?

What does the textbook creation process look like?

How to evaluate a textbook?
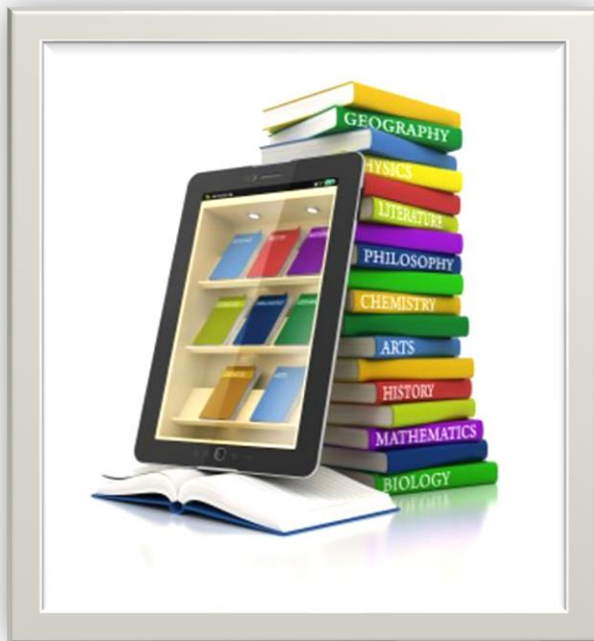
Preparation of teaching materials
Example of a textbook

Content

Introduction

It would be interesting to conduct research which is the first association with the term TEXTBOOK. The assumption is that for teachers in pre-university education, the textbook is more important in the teaching process than for teachers in higher education. For these reasons, the first part of the material in front of you will present the place of textbooks in formal education with an emphasis on the difference between pre-university and university education. The second part is dedicated to the quality of textbooks. The main question is: which role users (pupils and students) have in the assessment of the textbooks quality, and which role reviewers or teachers have? The third part presents the rules and additional recommendations for the preparation of a good university textbook. Finally, in the fourth part, a review of textbooks in the field of mathematics is given.

In order for the content of this material to be related to practice, we suggest that you go through its content in the following way. It would be good to work in pairs with a colleague who does not teach in the same area as you. Then each couple should choose one university textbook for basic academic studies in their fields. For example, one textbook could be Algebra 1 and the other Analysis 1 if the pair consists of two math teachers or Analysis 1 and Mechanics if the pair consists of a math teacher and a physics teacher. Both members of the pair should have both selected textbooks available. Using the proposed mastering procedure, you will be able to understand and critically review the presented content in a simpler way.

Exercise preparation:

Pair work: two teachers from different fields

Teacher 1 whose area is X.

Teacher 2 whose area is Y.

Step 1 : Selection of textbooks for analysis

Textbook X for undergraduate studies in field X

Textbook Y for undergraduate studies in field Y

Step 2: Each pair member should have both textbooks

Teacher 1 will evaluate textbook X as a reviewer, while he/she will evaluate textbook Y as a student.

Teacher 2 will evaluate textbook Y as a reviewer, while he/she will evaluate textbook X as a student.

Textbook in formal education

The twenty-first century brought unpredictable changes in education at all levels. The speed of change taking place in the world should cause major changes in the classroom, if we want pupils and students to achieve the necessary goals for continuing education and / or for inclusion in the labor market. One of the key competencies that needs to be developed in students is the competence for lifelong learning, which can be described as follows.

The personal and professional development of an individual is primarily based on his/her ability to manage the learning process. The student should be able to initiate learning, to choose learning strategies and design the context in which he/she learns, to monitor and control progress during learning, to manage learning in accordance with the intentions and goal he/she has. The student is able to find and assimilate new knowledge and skills, using previous learning and extracurricular experience. He/she is aware of the learning process, opportunities and difficulties in learning; he/she knows how to overcome difficulties and persevere in learning. He/she applies knowledge in different situations depending on the characteristics of the situation and his/her own goals.

One of the important aspects of the learning process is finding and using teaching materials. The development of technology has enabled the availability of materials for almost every area to grow exponentially, which on the one hand allows those interested to find an approach tailored to their needs or capabilities. However, on the other hand, the great availability and the possibility that just about anyone can make their prepared material available without any verification or review can be the cause of spreading incorrect or unverified claims, ie misconceptions. That is one of the biggest challenges of modern education. Critical access to materials and selection of appropriate ones is a necessary condition for a successful learning process. While in formal and partly in non-formal education, the teacher, ie the implementer, takes on the task of selecting teaching materials, most often textbooks, in informal education this role is taken over by the student himself. This means that in the first case the material is selected by an expert in the field or subject, while in the second case it is done by a student who has yet to develop his / her professional competencies. We can conclude that that is why working with teaching materials, and above all with a textbook, is an extremely important segment of the teaching process. In this context, it is important that students, in addition to acquiring subject competencies, through well-chosen textbooks master the additional competencies needed for self-education.

The first question that needs to be answered in order to consider the use and creation of textbooks in general is "*What is a textbook*?". Intuitively, each of us has an idea of what a textbook is, but there are many formal definitions. We list some of them.

The definitions

"A textbook is a book used in the study of a particular subject." (Merriam-Webster dictionary)

"A textbook is a book that contains detailed information about a subject for people studying that subject." (Cambridge Dictionary)

"A textbook is a book used in schools or colleges to formally study subjects" (https://www.thefreedictionary.com/textbook)

are extremely simple but also incomplete.

On the other hand, we have broader definitions like

"*A textbook is a book that contains a comprehensive compilation of content from one branch of study with the intention of explaining it.*" (https://en.wikipedia.org/wiki/Textbook)

"*A textbook is an organized material useful for the formal study of a subject area.*" (https://en.wikibooks.org/wiki/Wikibooks:Textbook_considerations)

"*A textbook is a basic didactically shaped teaching tool, in any form or medium, which is used in educational work in school to acquire knowledge, skills, form attitudes, encourage critical thinking, improve functional knowledge and develop intellectual and emotional characteristics of students and students, the contents of which are determined by the curriculum of teaching and learning and which is approved in accordance with this law.*" (Article 2, Law on Textbooks, "Official Gazette of RS", No. 27/2018)

Textbooks are of great importance at all levels of education. From the creation of the first textbook until today, the didactic function of the textbook has changed significantly. Initially, the textbook was the only form of school curriculum that students and teachers came in contact with. For pupils / students, the textbook was the basic means of learning, mainly for the reproductive form of learning. The main function of the textbook was to convey certain information according to the curriculum for a certain subject and class, or for a certain subject in studies. Nowadays, the view of textbooks is different, because the focus has shifted to the person who is learning. With its content and didactic means, the textbook helps to build the knowledge of the learner (Ivić, Pešikan, Antić, 2003). Thus, the textbook today is dominated by developmental in relation to the transmissible role (the role of knowledge transfer). Emphasis is placed on the process of building applicable knowledge, with the student's own effort.

Well-designed textbooks have the potential to make learning more fun, lasting, and meaningful with the ability to actively engage student cognition in a variety of ways, through mechanisms such as visual processing, analytical thinking, questioning, hypothesis testing, and verbal reasoning. The textbook is not just a set of useful information, facts and materials, it is a guide for the student for the order of learning that will help him master the subject area.

Example: In order to develop a better understanding of the role of mathematics textbooks in teaching and learning activities in mathematics, a theoretical model has been developed (Rezat, 2006a)
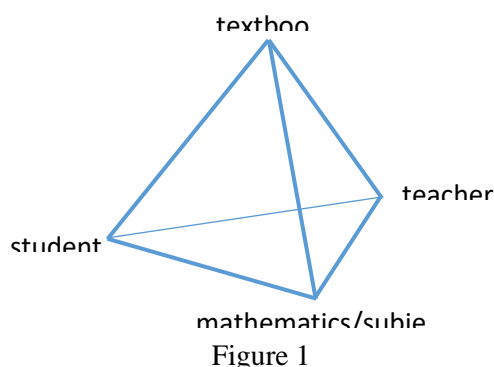

Figure 1

Figure 1 shows Shuvelar's model based on the basic model of the didactic system: the ternary relationship of student, teacher and mathematics. The math textbook is implemented as an instrument on all three sides of the triangle: teachers use textbooks to prepare teaching units, textbooks are used in class, and finally students learn from textbooks. Each triangle of the tetrahedron model represents a system of activities. Thus, the mathematics textbook has an impact on the activity of learning mathematics as a whole, which is represented by a didactic triangle at the bottom of the tetrahedron.

Textbooks in pre-university education

Serbia is a country that has chosen to regulate textbooks and other teaching aids differently at different levels of education. On the one hand, textbooks in pre-university education are regulated through very strong legal frameworks as well as strict procedures. The basic legal act is the Law on Textbooks (Law on Textbooks, "Official Gazette of RS", No. 27/2018).

Article 1 defines the subject of the Law as follows

"This law regulates the preparation, approval, selection, issuance, withdrawal and monitoring of textbooks and textbook sets, manuals and additional teaching aids for primary and secondary schools."

...

"Preparation, approval and issuance of textbooks for an institution that performs the activity of higher education is regulated by a general act of the higher education institution, in accordance with a special law."

The mentioned Law, the first version of which was adopted in 2009, enables the liberalization of the textbook market for primary and secondary education. However, such an approach has brought two opposing things.

On the one hand, the number of textbooks for primary education, especially for compulsory subjects, is large, probably too large, so the choice of textbooks is very often in the public spotlight. Although the quality standards are defined, that will be discussed later, the criteria of teachers when choosing textbooks are still unclear.

On the other hand, there is a significant part of secondary education, which primarily refers to vocational subjects in secondary vocational education, which do not have the appropriate literature. As the percentage of students in vocational education (about 74%) is significantly higher than in general (gymnasium) education (about 26%), this indicates that a significant part of the student population does not have appropriate textbooks and probably uses their notes or some other source.

Although the Law on Textbooks and the relevant bylaws regulate in detail the preparation, approval, selection, issuance, withdrawal and monitoring of textbooks, an extremely important segment remains uncovered, and that is the use of textbooks. The manner of using the textbook is left entirely to the subject teacher, who, if he assesses, does not have to use the textbook in teaching. Based on this approach, we can hypothesize that students do not master the use of textbooks and work with text in a systematic way.

Textbooks in higher education

In higher education, the textbook becomes important for two reasons. The first reason is that the textbook is the condition for elections in higher positions, and the second reason is that the textbooks are important in the procedure of accreditation of the institution and study programs.

ELECTION TO THE TEACHING POSITIONS: Publishing of a textbook is an obligatory condition for election to the position of full and associate professors in the natural-mathematical and technical-technological fields.

At least one of the following publications: published monograph, published textbook in the related field, a chapter in a textbook or monograph, a collection of problems or a practicum.

ACCREDITATION OF THE STUDY PROGRAM: Rulebook on standards and procedure for accreditation of higher education institutions ("Official Gazette of RS", No. 13/2019)

Standard 10: Library, textbooks and IT support

*The higher education institution has an appropriate library equipped with the **necessary textbooks** for teaching and IT resources and services that it uses in order to fulfill basic tasks.*

*10.2. The higher education institution provides coverage of all subjects with **appropriate textbook** literature, teaching aids and teaching aids. Teaching aids and teaching aids must be available on time and in sufficient numbers to ensure the normal conduct of the teaching process.*

Standard 11: Internal quality assurance mechanisms

*11.4. The higher education institution especially monitors the quality of teaching, exams, the success of students in studying as a whole and in individual subjects, **the quality of textbooks** and takes the necessary measures to eliminate the identified shortcomings.*

Each accredited higher education institution has adopted a rulebook which regulates the approval of textbooks. However, the contents of the regulations differ greatly.

Examples of the rulebook which regulates the field of textbook literature at higher education institutions in the Republic of Serbia.

Rulebook on textbooks, University of Novi Sad (http://www.uns.ac.rs/index.php/univerzitet/javnost-rada-2/dokumenti/aktiuns/send/35-pravilnici/257-prailnik-nastavna-literatura)

Rulebook on textbooks Faculty of Sciences, University of Novi Sad

(https://www.pmf.uns.ac.rs/wp-content/uploads/2019/12/3Pravilnik-o-udzbenicima.pdf)

Rulebook on textbooks Faculty of Sciences, University of Niš

(https://www.pmf.ni.ac.rs/download/akta/akta_fakulteta/pravilnik/Pravilnik-o-udzbenicima.pdf)

Quality of the textbooks

The primary goal of the textbook is not to provide information about a particular subject, but to enable the development of a proper understanding of the subject. The presentation is extremely important and is prepared to serve a certain level of the readership. The textbook cannot be comprehensive in terms of content or users. A good textbook takes into account the way of teaching and the level of the reading audience.

Textbooks should meet two conditions. The first of these are requirements related to the content (domain) of the subject. As textbooks are mostly written by subject experts, this condition is usually met. However, the second condition concerns the possibility of student cognition, which can also be described as: adaptation of the textbook to a student who does not have the appropriate knowledge for the subject area, but who should acquire it using the textbook. While the first condition is relatively easy to verify, this second condition is very often difficult to assess.

Textbooks come in a variety of forms and formats, depending on the subject and the capabilities of the student. Most textbooks in our education system are printed on paper, which is still a great medium, but an increasing number of publishing houses and, especially self-publishers, use digital media (eg Epub, iBooks, websites ...) to deliver content and contribute effective teaching and successful learning.

As already mentioned, at different levels of education, the approval of textbooks is regulated in different ways. In pre-university education, the approval and issuance process is strictly defined, while in higher education the situation is significantly different. In pre-university education, unlike in higher education, the quality of textbooks is clearly defined and all approved textbooks meet the minimum defined requirements. As a consequence of this approach, there is a higher quality of textbooks in pre-university education in relation to higher education.

Below we briefly present the quality standards of textbooks as basic elements in the process of approving textbooks in pre-university education. Based on the Law on Textbooks, the Rulebook on textbook quality standards and instructions on their use ("Official Gazette of RS", No. 45/2018) were adopted, which defined five areas of standards.

What are textbook quality standards?

Conditions to be met by textbooks and other teaching aids that are approved for use in preschool institutions, primary and secondary schools

What do textbook quality standards refer to?

On the content, pedagogical-psychological, didactic-methodical and linguistic requirements, as well as on the graphic and technical equipment of the teaching aid

What is the purpose of textbook quality standards?

Improving the quality of textbooks and other teaching aids in order to achieve the principles, goals and general outcomes of education and upbringing

Who are the standards for?

The Rulebook determines five textbook quality standards:

✓ Standard 1 - The content of the textbook is relevant to the realization of the curriculum

✓ Standard 2 - The textbook encourages student development and enables independent learning

✓ Standard 3 - The textbook is designed in accordance with the didactic and methodological requirements

✓ Standard 4 - The language of the textbook is appropriate and functional

✓ Standard 5 - The graphic and technical equipment of the textbook enables its easy use

✓ Each standard is assessed through several indicators. The following are examples of indicators for compliance with standard 1 and standard 3.

Indicators of compliance with standard 1:

1. The content of the textbook and its scope are harmonized with the curriculum of the subject.

2. The content of the textbook contributes to the achievement of educational standards and the development of students' competencies

3. The content of the textbook is based on accepted scientific theories, facts, conclusions, interpretations, current data and modern achievements.

4. There are no material errors in the content of the textbook.

5. Visual contents are clear, representative and have different functions.

6. The content of the textbook is in accordance with the value system defined by the goals of education and upbringing.

7. The textbook connects the contents within the same subject and other subjects.

8. Contents that are not provided by the curriculum are functional and follow the course of presentation in the textbook.

Indicators of compliance with standard 3:

1. The textbook has a clear, logical and coherent structure.

2. The textbook respects the didactic principles and methods of teaching the subject.

3. Content overview, title and subtitle system is organized on a clear principle and provides clarity and ease of reference.

4. The textbook contains structural components: introduction, overview of contents, functional units (lessons).

5. The functional unit (lesson) contains the basic text and didactic equipment (selected keywords, examples, assignments, summary of the lesson, illustrations - pictures, diagrams, maps, charts, etc.).

6. The examples given in the textbook are functional, diverse and relevant.

7. Questions, tasks and orders are logically related to the content, clearly formulated, different in complexity and function and encourage the application of what has been learned.

8. Tasks and orders are realistically feasible, they take into account the diversity of environments in which students live and do not endanger students, nor endanger the environment.

9. Unknown words and key terms are clearly highlighted and explained.

Development of a textbook

How to write a good textbook is a question that all teachers face at least once in their professional work. Often this process is long, arduous and full of challenges. Below we will look at some rules and criteria that can help future authors in their approach to textbook development.

First of all, we remind you that the organization of content and text is based on the intersection of two requirements. The first of them is a request regarding the subject contents. Since the authors of the textbook are, as a rule, experts in the subject for which the textbook is intended, the request for the subject content is usually not a big challenge. However, the second requirement relates to the capabilities of the student or user / reader. In this case, significant limitations may arise. Although cognition is a human ability, authors who have already mastered a subject area often ignore the mentioned limitations. In this way, on the one hand, we get an excellent textbook in terms of subject content, but on the other hand, it is almost useless for mastering subject content for those who have yet to become experts, ie for students. In order to make the best use of students' abilities, some rules for structuring and presenting ideas, concepts and materials in textbooks will be stated in the sequel.

Five rules of textbook development

The approach beyond textbook quality standards is extremely formal and often very strict, which can lead to unnecessary insistence on some of the indicators given the purpose of the textbook. Quality standards, ie their indicators are of great importance, first of all, for the approval and assessment of the quality of textbooks by reviewers. On the other hand, there are approaches that only outline the principles for preparing a good textbook. Below we present five such principles, or rules, (wikibooks.org). These principles put the student in the foreground, and the authors emphasize the most important cognitive processes that the student goes through and that it is necessary to take into account in order to prepare an appropriate textbook for the student.

1

Material structure

Memory and understanding are enhanced by using a structure that mimics the structures we all use in our minds to store information. Before we can use or master an object, we must have a mental roadmap that allows us to move within and through the domain of the object. The textbook can best help understand the content by making this box visible early within each section or topic. It is necessary for the student to recognize and use the frame as he goes through the textbook. The structure acts as a mental map that allows students to move within and through the subject domain.

Rule 1: The structure in the textbook should be consistent
The structure acts as a mental map that allows students to move within and through the subject domain**.**

2

Terminology

The introduction of the names of terms or concepts, as well as the appropriate titles, are crucial for the ability to remember things that the student knows. With consistent terminology, we achieve that the student can build an appropriate mental map that will enable him to master the intended content. It is important that one name is used for only one term or element in order to avoid unnecessary

misconceptions or obstacles to understanding. As an example of a confusing name, we cite the notion of *parameter estimates (ocena parametra)*, which are used in most literature in the Serbian language for several different terms. On the one hand, they are used as statistics, ie. a function of independent variables that serves to estimate the parameters (eng. *estimator*), while on the other hand, by the same name we call the value of that function for a specific sample (eng. *estimate*). It is often a big obstacle how to introduce names for new terms with regard to the Serbian language. Therefore, it is important to emphasize that the authors of university textbooks in the Serbian language should, in cooperation with linguists, enrich the vocabulary of the Serbian language by introducing new terms. The already mentioned example of parameter estimation can thus be replaced with two terms parameter estimator when referring to a function, and parameter estimation when referring to its value for a realized sample).

In case different names are used for certain terms, it is important to choose one and use it in the entire material. When introducing the term, it is desirable to mention other names for the term represented in the relevant literature. As an example, we use the term *feature* in statistics for which there are other relevant names such as *variable*, *characteristic* ... In addition, in materials written in Serbian, it is necessary to specify the appropriate term in English to enable students to more easily connect and the use of other sources. For the mentioned statistical term *obležje*, different names are used in English, such as *variable*, *feature*, *attribute* ...
.

Rule 2: Introduce and apply consistent terminology.
 The structure acts as a mental map that allows students to move within and through the subject domain**.** Terminology is crucial for the ability to remember things that a student already learned**.**

3
Quantity of information

When we learn from an outline, illustration, or example, most of us are limited in our ability to absorb new material. As we get to know a part of the subject domain, this amount increases, but for new material, four to six new elements represent a reasonable limitation. If the chapter outline contains twelve items, the student will forget the outline before reaching the last item. When the text does not support this rule, even a diligent student needs to repeat the material unnecessarily.

Textbook authors must always be aware that they are presenting material to students who are not experts in the field being presented. That is why it is crucial to assess the students' ability to absorb new content. Too much information is demotivating and encourages students to either give up or adopt content without sufficient understanding, making the acquired knowledge short-lived and often useless. However, we must not forget that the scope that students are able to accept is expanding as they become more professional in the field of the subjects they study. That is why there are often significant differences in textbooks intended for basic or master studies. In fundamental subjects (often compulsory subjects in undergraduate studies) it is extremely important that the textbook gradually provides information and ensures that students can master it.

Rule 3: Determine optimal quantity of information.
Limit the quantity of new information that you present at the same time taking care about capacities of students.

Hierarchy

Our mental frameworks are hierarchical. It is a well-known fact that when teaching students, it is necessary to take into account the student's ability to connect new contents with those he/she has already mastered. It is necessary to apply the same principle when preparing the textbook. This principle can be represented through three levels of hierarchy. The basic level represents everything that the student needs to know and what we assume he/she has mastered, and it is necessary to understand the current contents that are key elements of the hierarchy. The last level is linking to content that has yet to be processed. The presentation of the material in textbooks is very complex, and the principle of hierarchy is one of the key elements that ensures the cohesion of the content.

Rule 4: Upgrade new knowledge to learned knowledge.

We must make sure that the student has acquired the necessary knowledge before accessing the next content. The textbook should provide him/her with a clear insight into the hierarchical construction of content.

Repetition

Starting from the fact that most students learn by repetition, it is important to point out, ie determine the contents of the subject (facts, concepts) that are important for students to know in the long run. These selected elements need to be presented in textbooks on several occasions. It can happen that we repeat some elements five or six times in the textbook. In this way, we achieve that the student masters them with greater understanding, as well as to fit them or connect them with different contents. Some elements need to be repeated a smaller number of times, while some elements will not be repeated at all. Through this principle, we further build the student's mental map. Exercises and review sections ideally contribute to a designed repetition pattern.

Rule 5: Repeat key elements to become part of long-term memory.

Choose the contents (facts, terms, concepts) that are necessary for students to know in the long run and return to them several times in the textbook.

Additional recommendation for preparation of a textbook

Finally we list simple and useful recommendations that can be used in the process of developmet of a textbook or some other teaching material. The recommendations are mainly adopted from Jose Pikardo (https://www.josepicardo.com/education/a-textbook-problem-seven-suggestions-to-improve-the-quality-of-published-resources/). Although some of the recommendations seems to be very simple, there are many textbooks where they are not applied.

Introduce new topics by referring to what the student already knows

Many textbooks introduce new topics by referring to learning objectives and outcomes, and then dive into any new topic that the chapter introduces. Because research shows that better learning occurs when students build on prior knowledge, you can begin chapters with activities that require students to recall and, in a sense, activate prior knowledge, thus strengthening the links between existing and new knowledge.

Linking images to text

It is clear that textbooks should be aesthetically appealing. It is important not to neglect affective factors (attitudes, perceptions, feelings) that can negatively affect a student's propensity to learn before he or she has had a chance to begin learning. Although we stereotypically strive to determine that academic rigor is negatively correlated with the number of illustrations, it is possible to produce textbooks that are both engaging and support effective teaching.

Lack of illustrations greatly reduces the quality of textbooks, but redundant illustrations can affect in the same way. A major challenge for authors is to find the right balance between text and illustrations and to pair illustrations that will support the learning process with the text.

Well-designed graphic illustrations clearly show models, present abstract concepts, and reveal basic knowledge structures that will help students establish the necessary connections for further learning.

In a digital environment, illustrations can come to life, which can be very useful, but it is important that the animations are simple so as not to distract unnecessarily. Carefully selected videos can also be embedded to provide examples and facilitate conceptual understanding.

Interweaving different but related topics and skills

Interweaving is the practice of alternately changing different topics and types of content. Although we intuitively feel that we learn better by focusing on one topic or skill at a time, research shows that better learning is achieved when students deal with different but related topics or skills at the same time, instead of focusing on one topic or skill and then another topic or skill, et cetera. Although the illusion of better learning is achieved by studying topics in blocks, in fact, by intertwining topics and skills, long-term knowledge and greater overall understanding are achieved.

Students and teachers may find this approach less appropriate and vague, but research unequivocally shows that intertwining leads to better overall learning in the long run. In the case of a digital format of textbooks or teaching materials, careful linking via hyperlinks between related topics can support the intertwining of key topics and concepts if a digital format is used.

Teaching independent learning skills in order to strengthen metacognition

Although many textbooks promote independent learning, for example, by referring students to additional resources, relevant websites, videos, and more, few actively seek to teach certain metacognitive strategies to help students become more successful in a particular subject. It is often considered that the purpose of the textbook is for the student to learn, ie to adopt the contents, and not for the student to learn how to learn.

Frequent self-assessments

The textbook should enable the student to self-assess understanding in each key part, ie in places where key elements of the content are processed. It is necessary to choose appropriate forms of questions and tasks that will unequivocally provide students with information about the achieved level of understanding of the content.

A review of mathematics textbooks

Mathematics as a subject regardless of the level of education has its own specifics. First of all, understanding mathematics implies the use of different ways of thinking and reasoning. Abstraction, generalization and deduction are extremely big challenges posed to the student who learns, but also to the teacher who teaches.

"For the sake of form, we talk about what students" need "to learn, while they struggle with much more significant problems, trying to learn our language and decipher our thought processes. Books compensate for this by giving examples for solving all possible types of homework. professors compensate by giving homework and control assignments that are much easier than the material that is "passed" on the course, and then evaluate them on the basis of criteria that do not require much understanding. We assume that the problem lies in the students, and not in the communication, believing that the students are either not good enough or are not interested enough. Observers outside the profession are amazed at this phenomenon, but we mathematicians just shrug our shoulders. ”(Thurston, 1994)

Mathematics content often requires great effort on the part of the student. The formal approach can often be demotivating for the student, so the conclusion is that the classical proof should be modernized and give way to other means that contribute to the acquisition of mathematical facts and knowledge.

"Formalism without understanding and understanding without formalism are also possible. In any case, the ability to recite a learned proof of a theorem is not the same as understanding the theorem. The real goal is to understand. ”(Uhl & Davis, 1999)

Understanding mathematical concepts underlies the teaching of mathematics and is necessary for the adoption of mathematical content. In an article (Mac Line 1994), author Sondrers McLainsuggests the following order in understanding mathematical content:

intuition - trial - error - thinking - predicting - proof.

In contrast, the typical order is largely represented in the teaching of mathematics:

lecture - memorization (practice of typical tasks) - testing.

A significant number of active mathematicians agree with McLain's description, making it inevitable to conclude that the mathematics we practice does not match the mathematics we teach. The questions that have been open for many years are:

Can the math we teach be aligned with the one we actually practice?

Can we arouse students' interest in mathematics?

In the paper (Uhl and Davis 1999), the authors state

"It is better to ask students for explanations, not proofs: The words "prove" and "show" are the scariest music for the ear of an inexperienced mathematician. The word "explain" doesn't sound so scary, since explanations are usually thought to be less formal than evidence. On the other hand, a valid explanation usually contains key ideas that are also contained in the formal proof, so concentrating on the explanation, instead of on the formal proof, does not degrade the mathematical understanding.
In fact, formalism and understanding usually do not go hand in hand: formalism resides in one part of the brain, while understanding permeates the brain, heart and soul."

After this brief review of some key aspects of learning mathematics, the conclusion is that creating a good textbook in the field of mathematics requires great effort. First of all, the first problem that the authors encounter is at what level of knowledge in mathematics is the student who will use the textbook. Authors should clearly define what they expect the student to know and understand, and what encompasses concepts and claims, as well as the level of understanding. If we do not make it clear to the student, he/she will probably very quickly give up working with the textbook or start learning without understanding.

Textbooks in mathematics, as well as in other fields, differ in quality. Below we give examples of four textbooks in mathematics and invite the reader to first make hypotheses about the observed textbook on the basis of only selected pages, and then to approach the above textbooks and to show the quality of each of them.

Example A: Berchie Holliday, Gilbert J. Cuevas, Melissa S. McClure (2004), *Advanced Mathematical Concepts: Precalculus with Applications, p.786*

which implies that $x - y \in \mathcal{N}(T)$ and consequently $x - y = 0$ or $x = y$. ∎

Before we proceed with the next examples we shall prove a fundamental equality relating rank and nullity of a linear transformation T defined on a finite-dimensional space.

THEOREM 2.5.1

(Rank and Nullity Theorem)

Let V be a finite-dimensional vector space and $T : V \to W$ denote a linear transformation from V into another vector space W. Then

$$\dim V = \dim \mathcal{N}(T) + \dim \mathcal{R}(T)$$

i.e., the sum of rank and nullity of linear transformation T equals the dimension of space V.

PROOF   Denote $n = \dim V$ and let $e_1, \dots, e_k$ be an arbitrary basis of the null space. According to Theorem 2.4.3, the basis $e_1, \dots, e_k$ can be extended to a basis $e_1, \dots, e_k, e_{k+1}, \dots, e_n$ for the whole V with vectors $e_{k+1}, \dots, e_n$ forming a basis for a complement of $\mathcal{N}(T)$ in V. We claim that vectors $T(e_{k+1}), \dots, T(e_n)$ are linearly independent and that they span the range space $\mathcal{R}(T)$. To prove the second assertion pick an arbitrary vector $w = T(v)$. Representing vector v in basis e_i, we get

$$w = T(v_1 e_1 + \dots + v_k e_k + v_{k+1} e_{k+1} + \dots + v_n e_n)$$
$$= v_1 T(e_1) + \dots + v_k T(e_k) + v_{k+1} T(e_{k+1}) + \dots + v_n T(e_n)$$
$$= v_{k+1} T(e_{k+1}) + \dots + v_n T(e_n)$$

since the first k vectors vanish. Thus $T(e_{k+1}), \dots, T(e_n)$ span $\mathcal{R}(T)$. Consider now an arbitrary linear combination with coefficients $\alpha_{k-1}, \dots, \alpha_n$ such that

$$\alpha_{k+1} T(e_{k-1}) + \dots + \alpha_n T(e_n) = 0$$

But T is linear, which means that

$$T(\alpha_{k+1} e_{k+1} + \dots + \alpha_n e_n) = \alpha_{k-1} T(e_{k+1}) + \dots + \alpha_n T(e_n) = 0$$

and consequently

$$\alpha_{k+1} e_{k+1} + \dots + \alpha_n e_n \in \mathcal{N}(T)$$

The only vector, however, which belongs simultaneously to $\mathcal{N}(T)$ and its complement is the zero vector and therefore

$$\alpha_{k+1} e_{k+1} + \dots + \alpha_n e_n = 0$$

which, since $e_{k+1}, \dots, e_n$ are linearly independent, implies that $\alpha_{k-1} = \dots = \alpha_k = 0$ from which in turn follows that $T(e_{k+1}), \dots, T(e_n)$ are linearly independent as well.

Example B: Demkowicz, Leszek; Oden, John Tinsley (2018), *Applied functional analysis, p.144*

7.1.6. Write out the system of equations for the linear map whose corresponding matrix is $\begin{pmatrix} 2 & -3 \\ 6 & 2 \end{pmatrix}$.

7.1.7. Write out the system of equations for the linear map whose corresponding matrix is $\begin{pmatrix} 4 & 0 \\ 2 & 1 \end{pmatrix}$.

7.1.8. Where would the point $(7, 3)$ be mapped to by the linear map whose corresponding matrix is $\begin{pmatrix} 0 & 0 \\ 0 & 0 \end{pmatrix}$?

7.2 Old Friends

In this section, we'll be taking a closer look at some of the things that linear maps can do for us. You'll see that some of the transformations you've known for years can be achieved by matrix multiplication!

Mirror Images

Working on a 2-dimensional plane, one of the basic transformations that we might want to consider is reflection. Reflection is the process of taking the "mirror image" of the plane, about some given axis of reflection. We'll start by looking at reflection in lines which result in particularly nice matrices, and then we'll move onto a general case.

First up, we're going to look at reflection in the x-axis, as shown in Figure 7.1.

Let's consider exactly what a reflection like this does to our (x_0, y_0). The x coordinate is the same before and after the reflection, so we can immediately see that $x_1 = x_0$. The y coordinate, however, doesn't stay the same: its sign is reversed when the reflection takes place. This means that $y_1 = -y_0$. Putting these two equalities together gives us:

$$x_1 = \quad x_0$$
$$y_1 = \quad -y_0$$

This corresponds to the matrix:

$$\begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix}$$
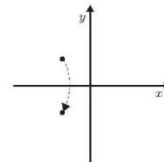
Figure 7.1

Similarly, we can reflect about the y axis. This time our y coordinate is left unchanged by the reflection while the sign of the x coordinate changes, so our system of equations is:

$$x_1 = \quad - \quad x_0$$
$$y_1 = \quad y_0$$

This corresponds to the matrix:

$$\begin{pmatrix} -1 & 0 \\ 0 & 1 \end{pmatrix}$$

Now that we've seen some specific cases of reflection, it's time to move towards a more general case. We're going to examine reflection about any line passing through the origin: the two lines above were certainly examples of that, so let's explore a little deeper. A good starting point would be reflection about the line $y = x$, as in Figure 7.2.

Let's think carefully about what this reflection does to (x_0, y_0). After we apply the reflection, the x coordinate becomes the y coordinate and the y coordinate becomes the x coordinate. We therefore have the system of equations:

$$x_1 = \quad y_0$$
$$y_1 = \quad x_0$$

Which corresponds to the matrix:

$$\begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}$$

Example C: Edward Hurst, Martin Gould (2009) *Bridging the Gap to University Mathematics. p95-96*

CHAPTER 3

SYMBOLIC LOGIC AND PROOFS

Logic is the study of consequence. Given a few mathematical statements or facts, we would like to be able to draw some conclusions. For example, if I told you that a particular real-valued function was continuous on the interval $[0,1]$, and $f(0) = -1$ and $f(1) = 5$, can we conclude that there is some point between $[0,1]$ where the graph of the function crosses the x-axis? Yes, we can, thanks to the Intermediate Value Theorem from Calculus. Can we conclude that there is exactly one point? No. Whenever we find an "answer" in math, we really have a (perhaps hidden) argument. Mathematics is really about proving general statements (like the Intermediate Value Theorem), and this too is done via an argument, usually called a proof. We start with some given conditions, the *premises* of our argument, and from these we find a consequence of interest, our *conclusion*.

The problem is, as you no doubt know from arguing with friends, not all arguments are *good* arguments. A "bad" argument is one in which the conclusion does not follow from the premises, i.e., the conclusion is not a consequence of the premises. Logic is the study of what makes an argument good or bad. In other words, logic aims to determine in which cases a conclusion is, or is not, a consequence of a set of premises.

By the way, "argument" is actually a technical term in math (and philosophy, another discipline which studies logic):

Arguments.

An **argument** is a set of statements, one of which is called the **conclusion** and the rest of which are called **premises**. An argument is said to be **valid** if the conclusion must be true whenever the premises are all true. An argument is **invalid** if it is not valid; it is possible for all the premises to be true and the conclusion to be false.

For example, consider the following two arguments:

If Edith eats her vegetables, then she can have a cookie.
Edith eats her vegetables.
∴ Edith gets a cookie.

Florence must eat her vegetables in order to get a cookie.
Florence eats her vegetables.
∴ Florence gets a cookie.

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(The symbol "∴" means "therefore")

Are these arguments valid? Hopefully you agree that the first one is but the second one is not. Logic tells us why by analyzing the structure of the statements in the argument. Notice the two arguments above look almost identical. Edith and Florence both eat their vegetables. In both cases there is a connection between the eating of vegetables and cookies. But we claim that it is valid to conclude that Edith gets a cookie, but not that Florence does. The difference must be in the connection between eating vegetables and getting cookies. We need to be skilled at reading and comprehending these sentences. Do the two sentences mean the same thing? Unfortunately, in everyday language we are often sloppy, and you might be tempted to say they are equivalent. But notice that just because Florence *must* eat her vegetables, we have not said that doing so would be *enough* (she might also need to clean her room, for example). In everyday (non-mathematical) practice, you might be tempted to say this "other direction" is implied. In mathematics, we never get that luxury.

Before proceeding, it might be a good idea to quickly review Section 0.2 where we first encountered statements and the various forms they can take. The goal now is to see what mathematical tools we can develop to better analyze these, and then to see how this helps read and write proofs.

3.1   PROPOSITIONAL LOGIC

Investigate!
You stumble upon two trolls playing Stratego®. They tell you:
  Troll 1: If we are cousins, then we are both knaves.
  Troll 2: We are cousins or we are both knaves.

Could both trolls be knights? Recall that all trolls are either always-truth-telling knights or always-lying knaves.

Attempt the above activity before proceeding

A **proposition** is simply a statement. **Propositional logic** studies the ways statements can interact with each other. It is important to remember that propositional logic does not really care about the content of the statements. For example, in terms of propositional logic, the claims, "if the moon is made of cheese then basketballs are round," and "if spiders have eight legs then Sam walks with a limp" are exactly the same. They are both implications: statements of the form, $P \to Q$.

Example D: Oscar Levin (2019) Discrete Mathematics. An open Introduction, p197-198

Instead of a conclusion

Textbooks are still one of the key elements of the teaching process. There are different challenges that are present today when using textbooks and different views on their future. However, it is difficult to imagine formal, but also other forms of education without textbooks or appropriate teaching materials.

Of course, different education systems face different problems. One of the biggest problems in Serbia is the insufficient number of textbooks in the Serbian language. Translating or writing textbooks is a demanding and expensive job, so small markets such as the markets in our country do not provide a simple solution to this problem. On the other hand, in some educational systems the price of university textbooks is one of the key problems. In the paper (Martin, Belikov, Hilton III, Wiley, & Fischer, 2017) they conducted research at a large private university (Brigham Young University, Provo, Utah, USA). The students who participated in the research stated that they make decisions about which courses to attend based on the specific costs of the textbook. On the other hand, the faculties stated that they are ready to use open textbooks to ease the burden on students, but they are not sure where they can find favorable opportunities. It turned out that 66% of students at this institution did not buy the textbook due to costs. It was also found that 91% of teachers in this institution would be willing to use open educational resources (OER) alternatives and that 53% of them would welcome help in identifying and adapting materials for their course.

Jung, Bauer, & Heaps (Jung, Bauer, & Heaps, 2017) also explore the possibility of OERs in higher education. The high cost of tuition and textbooks can have a negative impact on potential students from lower socioeconomic backgrounds. Open educational resources offer students a way to save on educational costs by using high-quality open textbooks. The presented study explores the open textbooks provided by OpenStak. Specifically, the study uses the COUP (Costs, Outcomes, Uses, Perceptions) framework to examine: (1) cost reductions, (2) outcomes, (3) uses, and (4) faculty perceptions of the quality of OpenStak textbooks. Overall, the findings suggest that the use of OpenStak textbooks can achieve significant financial savings with some pedagogical changes.

We refer interested readers to new research related to the use of textbooks in higher education as well as the (in) ability of digital textbooks to replace paper versions (Fischer, Hilton, Robinson, & Wiley, 2015; Meyer et al., 2015; Shepperd, Grace, & Koch, 2008) Udžbenici su i dalje jedan od ključnih elemenata nastavnog procesa.

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QUESTIONS:

How to link evaluation and learning outcomes?

How to prepare instruments for different evaluations?

How to evaluate a student?

How does evaluation and self-evaluation affect student achievement and motivation?

How to assess the quality of evaluation?

How to test knowledge and examine students online?

Assesment of student knowledge
How to evaluate math students?

Contents

Introduction

Every teacher, regardless of the level of education he teaches, encounters a large number of questions related to evaluation and on which he tries to find appropriate answers. The most common questions we ask are:

- ✓ What is the role of evaluation?
- ✓ How can we choose the right grading methods for our course?
- ✓ How consistent is the evaluation with the outcomes?
- ✓ How can a monitoring plan and matrix help make an appropriate assessment?
- ✓ Is it possible to make an absolutely reliable and valid assessment?
- ✓ How can the formulation of good questions and assessment tasks affect reliability and validity?
- ✓ What is the role of feedback?
- ✓ How to provide feedback?
- ✓ How to draw conclusions from exam analysis and improve future exams?

✓ If good students fail to solve assignments, what does this say about the assignment, and what about teaching?

Student evaluation is certainly one of the most important segments of the teaching process. It requires great knowledge and commitment of teachers, because it includes several important steps such as preparation, assessment that is constructively aligned (content, level, methods) with the objectives and activities of the course, and the application of quality criteria for validity, reliability and transparency of assessment. Therefore, in order for teachers to be able to evaluate students' knowledge, this activity needs to be harmonized at the level of the entire study program. Below are two descriptions of the evaluation cycle that overlap significantly.

Evaluation cycle 1.

Taken from: https://uwm.edu/academicaffairs/facultystaff/assessment-of-student-learning/program-assessment-cycle

/
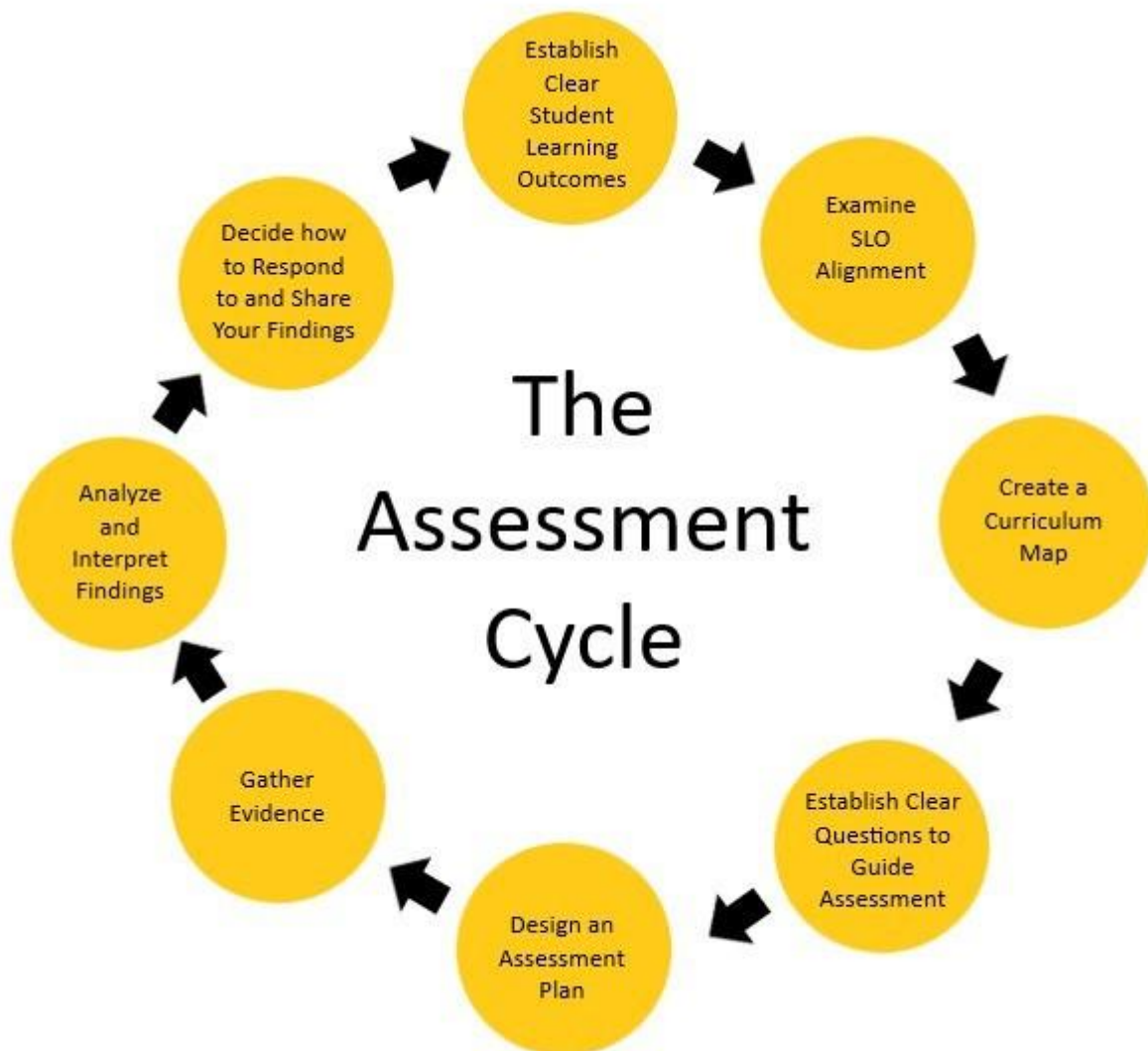
Student learning Outcomes (SLO)

Department and program faculty first agree on what it is that students should learn, or what students graduating from their program should be, know, or be able to do. Each department or program then develops clearly written and agreed upon Program Learning Goals and Outcomes.

Alignment

Alignment is the process of ensuring that course learning outcomes, program learning outcomes, and institutional goals correspond with one another. Individual faculty are responsible for ensuring alignment with program goals in their courses, although the program as a whole is responsible for ensuring overall alignment with institutional goals.

Curriculum Mapping

Creating a curriculum map allows programs to ensure that each program goal and outcome is adequately addressed throughout the course of study. It clarifies which courses are responsible for delivering opportunities and content to help students achieve particular outcomes. The curriculum map helps ensure that desired program skills or knowledge are introduced, re-affirmed, and developed across multiple required courses.

Asking Questions

Good assessment plans begin by asking clear and specific questions that reflect faculty concerns and values. The most basic assessment question present in *all* program assessment plans is "What, or to what degree, have our students learned?" Faculty may design assessment plans that also address more specific programmatic questions about the factors and conditions affecting student learning, such as how a new curriculum is affecting student test scores, or if a curriculum is working equally well for different student populations in the program.

Designing an Assessment Plan

The program assessment plan is designed to gather evidence to evaluate the health or effectiveness of the program, and is different than student assessment. While student assessment asks if a student has demonstrated a skill or learning sufficiently to pass, graduate, or earn a particular grade, program assessment uses indicators (which may include student assessment results) to evaluate the program. Each program determines what kind of evidence will best illuminate their assessment questions. Assessment plans include establishing targets for acceptable program outcomes, and accounts for what kind of evidence is needed and how to gather that evidence with available resources.

Gathering Evidence

Programs and courses already produce evidence of learning. The most sustainable assessment plans capitalize on *embedded* assessment, by capturing and evaluating student work already being produced in a way that allows it to be aggregated for program assessment purposes. Evidence can be direct or indirect and should be appropriate to what is being assessed.

Analyzing Data

Data rarely speaks for itself. Programs and faculty work to make sense of their assessment data, whether qualitative or quantitative, and determine what their results mean in the local context of their program. That process can be collaborative, or programs may designate qualified faculty or staff to examine assessment data, contextualize it, and explore what conclusions can be drawn.

Responding and Sharing

The results of program assessment are first, and most importantly, shared with program faculty to determine what response is needed and to develop an action plan to implement the response. Assessment data highlights program successes and strengths, while also helping faculty identify needed changes in curriculum, professional development, academic support structures for students, or even in the assessment plan itself. As part of the accreditation process, programs report their assessment activity, data, and resulting action plans.

The Assesment Cycle 2

Taken from:
https://www.celt.iastate.edu/teaching/assessment-and-evaluation/steps-in-the-assessment-cycle/

Systematic Cycle of Assessment

Identify Outcomes

Develop Methodology

Mission/Purpose Goals

Implement Change

Gather and Interpret Evidence

Adapted from: Maki, P. L. (2010). *Assessing for learning: Building a sustainable commitment across the institution* (2nd ed.). Sterling, VA: Stylus Publishing, LLC.

Effective assessment should be viewed as an iterative process but does not need to be overly complex or time consuming. The steps in the assessment cycle can be used to organize your assessment activities.

Assessment is a process that, similar to teaching, should begin with outcomes and goals. Assessment is more than developing a survey, collecting and analyzing data. Although these are steps in the assessment process, assessment is most useful when it is connected with the broader institution mission and goals, has identified outcomes, and has plans in place to utilize the data to document student learning and/or make improvements.

1. Any assessment should connect to the broader mission, purpose, goals, and objectives.
    1. What is the purpose of doing this assessment?
    2. How does this purpose fit in the larger context?
2. Begin by identifying your outcomes or learning objectives.
    1. Are these outcomes/objective measurable?
    2. How will I know if they are achieved?
3. Develop method:
    1. How will you assess the outcomes?
    2. Do you have access to data or can gather data to measure the outcomes?
    3. What methods/measures will you use?
4. Gather Evidence – collect data
5. Interpret Evidence
    1. Analyze results and interpret results based on the learning outcomes and assessment purpose. Analysis can be qualitative, quantitative, or using mixed methods.
6. Implement Change
    1. Good assessment requires putting results into action. Use the results of your assessment to make changes to improve what was studied.
7. Using information from prior assessments, make changes to your assessment plan, and begin again.

As the assessment cycle imples the process of assessing and evaluating, this process requires continuous modification in order to achieve the set outcomes. New innovative methods appear very often. Here is an example

Practice points (Lambert W. T. Schuwirth & Cees P. M. van der Vleuten (2011): Programmatic assessment: From assessment of learning to assessment for learning, Medical Teacher 33(6):478-85): .

- In educational settings assessment for learning should take priority over assessment of learning. .
- A programme of assessment should aim at building n:n relationships: each competency domain should be informed from various assessment sources and each assessment source should be used to inform about several competency domains.
- For programmatic assessment as part of assessment for learning, extensions to current psychometric approaches are needed.
- The role of human judgement in assessment should be re-appraised and studied.

As at universities in Serbia, evaluation and assessment is largely, almost 100%, left to the subjectivity of teachers in an individual subject without coordination at the level of programs or institutions, it is very important to pay far more attention to this important segment of teaching. One possibility is to develop online training based on good examples such as online courses

Assessment in Higher Education: Professional Development for Teachers developed at Erasmus University Rotterdam (https://www.coursera.org/lecture/assessment-higher-education/perspectives-why-do-we-assess-in-higher-education-ij1cR)

Evaluation of math students

In the continuation of this text, we deal with the evaluation of students within the study programs of mathematics. The basic idea is that the evaluation should start from the learning goals and outcomes of the study program as a whole and also of a particular course. What is actually monitored and evaluated is the achievement of those goals and outcomes, which are defined in the curriculum. We will mention everything we monitor in the framework of monitoring goals and outcomes, what are the instruments for evaluating student work, how assessment is done, as well as the possibility of organizing exams online, which could be an interesting option in light of the current pandemic.

What we follow: learning goals and outcomes

Learning goals (of a subject) are the starting elements for the realization of a subject. All other elements of the organization of a subject follow from the goals and learning outcomes associated with them. The goals of individual courses are directly related to the goals of the study program. Usually, the goals of a course are statements about the expected achievements of students after taking that course. Theoretically, the goals are divided into cognitive goals and process goals. Cognitive goals talk about what the student will learn, and process goals talk about the skills that are acquired during the acquisition of that knowledge.

Learning outcomes are related to the goals and represent clear statements about what the student will be able, know or be able to do when he / she masters the subject.

Therefore, for each study program and each subject, the goals and outcomes that the student should adopt are clearly and unambiguously defined, and after they are adopted, the student takes the exam. Monitoring a student's work on a subject means monitoring the achievement of goals and the adoption of outcomes.

Initial check (START)

It is recommended that an initial test of the student's knowledge be made in the initial classes of each subject. It is important for the teacher to check at the beginning whether the students have the appropriate initial knowledge to be able to follow the subject. In addition to checking whether the students have the necessary knowledge, it is important to see how homogeneous (heterogeneous) the student group is and for the teacher to make a teaching strategy for that school year right at the beginning. This initial verification may be anonymous. It can be a multi-answer test that tests a student's

knowledge, as well as some simpler tasks to test the skills needed. This initial check is not related to grading, giving points and the like (since it can be anonymous).

> Initial assessment is an assessment of students' previous achievements and knowledge within certain areas, subjects or topics that are relevant to the subject.

There is a possibility that during the description of the subject (in the so-called subject sheet where the subject is described) it is defined that the subject can be enrolled only if some previous exams have been passed. Even if students have passed exams in some key subjects on which this course is based, it is necessary to do an initial test because it is possible that students have forgotten some details from the previous subjects and the teacher checks with this test whether and how much detail students should be reminded of some previous topic needed for current subject.

Monitoring during the teaching process (RACE)

It is important that during the teaching process, the teacher is aware of whether students are following him, whether they understand what is currently being taught. If that is not the case, then the teaching process loses its meaning. So, a teacher can follow students in several ways, one is to ask questions and make sure that students understand during the teaching process itself. It is possible to use some simpler means, such as automatic testing (there is a lot of free software that allows this). In addition, it is possible to set homework assignments, which will carry some points, but it is recommended that the assignments be open-ended, or that each student be given their own assignment. In addition, it is possible to do smaller tests that will also carry points, and certainly colloquia that will carry more points. All these points will be counted in final evaluation of students. So, it is possible to follow students in various ways during the teaching process, but it is important that the teacher has information on how much students are up to date with the subject. Communication between the teacher and the assistant is also important here (if there is an assistant), because usually the teacher gives lectures, and the assistant exercises. During the teaching process, the student usually collects points for the activity, homework, tests and colloquia, and it may happen that the student has already reached the number of points needed to pass the exam. By his/her activity and execution of various tasks, the student showed that he achieved the goal and reached the required outcome for that subject. Usually students who pass the exam by collecting a large number of points during classes take the final exam to get extra points and get a higher grade.

Final check (FINISH)

As mentioned, most students collect points during the course, and some of them already have enough points to pass the exam. It also depends on how the course is organized and in most cases it is still not possible to pass the course without a final exam. Depending on the objectives and outcomes of the course and how they can be measured, there are several methods for testing knowledge, but usually a written exam, an oral exam, a practical exam or a defense of a seminar paper are organized. Sometimes the goals and outcomes are formulated in such a way that the final exam is written, ie in that way the outcomes are checked. And if the outcomes are formulated as an understanding of a scientific discipline, then often the way to check is an oral exam. In case the goal is to acquire some practical skills, then the

final test is a practical exam. And if the goal is training for independent solving of a problem or a more complex task, then one can write and defend a seminar paper. This does not exhaust the possibilities of the final test, teachers make a strategy for checking depending on the objectives of the subject and the required outcomes and often check two or more aspects, so accordingly the exam is often a combination of practical and oral, written and oral and the like.

Feedback (TIME-OUTS)

It is very important that the teacher and the assistant get information from students with opinions on all aspects of teaching, such as how to transfer knowledge, adequate textbook, readiness of teachers to dedicate themselves to students, testing knowledge, comprehensibility and usefulness of the subject. If it is a matter of university- organized surveys, they are general and often students are not able to evaluate properly, they are afraid that the survey may not be anonymous and give mostly good grades. The teacher should study these surveys in detail, and especially the answers to open-ended questions, because they may indicate some aspects to which he/she did not pay enough attention. The teacher can also conduct a personal survey and ask students questions about the aspects of teaching that particularly interest him/her

Evaluation instruments

Types of tasks / questions

It is very difficult to choose a task and the type of task that will measure the student's achievement in a relevant way.

IT IS A VERY DIFFICULT TASK TO CHOOSE A TASK !!!

It starts from the theoretical framework, and the student should be given a task that corresponds to the real situation.

There are usually standard exercises from a subject that are done with assistants during excercise-classes and that use a given theory. It's a bit harder to choose an exam assignment so it's neither too easy nor too difficult. If a task is given that is identical or very similar to the one done in the exercise-classes, the question is whether this evaluates the adoption of the outcome in a good way. It is possible that this task is done by a student who did not understand the essence of the subject, but only automatically reproduced the task he/she learned. If the task is too difficult or long, it may happen that none of the students do it on the exam and then again such a task is not a good instrument for evaluation in this context.

In this sense, it is important for both younger and older teachers to follow the professional literature, to use self-assessment, to be ready for criticism from students and other colleagues, and to discuss assignments with other colleagues from related fields.

In the task, the teacher should be aware of the following aspects:
Purpose (goal) of the task

Formulation (it is important that the task is formulated clearly and precisely)

Time and working conditions (it is important to estimate the time needed to complete the task and to define whether the student is allowed to have a calculator, computer, literature, etc.)

Evaluation of the task (it is important that the teacher is aware in advance how the task or parts of the task will be evaluated).

Tests

Monitoring students' knowledge during the year can be done through tests. It is possible to conduct shorter tests within the time allotted for lectures. The tests also serve the teacher to assess how many students follow the lectures and how much material they have adopted so far, as well as the student to check his knowledge and win a partial number of points that will enter the final score. The test involves a written test of student achievement.

In tests, it is also important to take into account several aspects:

Purpose (goal) of the test: does the test really check what we wanted to check?

Selection of tasks (it is important how to choose tasks for a short test so that it measures student achievement)

Time and working conditions (as already mentioned, it is necessary to estimate the time required for the test and the allowed material during the test, in example whether students can use the text-book).

Total score (it is important that the test is well assessed in order to define exactly how many points that test carries in the total score for the subject).

Different types of test tasks:

1. completing the answer

2. dichotomous questions

3. multiple choice with one correct answer

4. multiple choice with multiple correct answers

5. connectivity issues

6. open question

Sometimes it is good to give short tests that use some of the types of tasks 1-5, where it is necessary to check whether the student has mastered the basic theoretical knowledge.

Most math tests at the university level will generally contain open-ended questions in which students will solve various (basic) tasks or give basic definitions. Such tests can measure whether students have achieved partial goals and outcomes and how well they attend lectures. Testing during semmester helps teachers to design further lectures.

Seminar papers

A seminar paper from a subject is an independent work of a topic that is related to the area of that subject. It is a type of academic work, the preparation of which is prescribed by the curriculum and it is one of the first experiences in writing professional papers. In the case of seminar papers, when setting the topic, it is necessary to assess the extent to which the preparation of that paper measures the achievement of goals and outcomes for that subject. In any case, for the seminar work in undergraduate and master studies, as a rule, original research is not required and the seminar paper does not contain

new, original scientific knowledge and results. However, the seminar paper can serve as a good exercise for the upcoming preparation of more complex, extensive and meaningful papers, such as the final thesis (if it exists in undergraduate studies), master's thesis, possibly scientific papers and others. So, in addition to the subject competencies, writing a seminar paper also contributes to other competencies, such as the way of writing the paper, the way of quoting literature and the like. The whole process, choosing a topic, studying the literature, formulating the paper, technical writing and arranging the paper, defending the paper, gives the student significant general competencies. The program for the course defines how many points the seminar paper brings and whether it is obligatory or optional. Through reading and monitoring the defense of the paper with asking questions that the student answers, the teacher assesses whether the student has achieved the goals and outcomes of the subject.

Final works (thesis)

The final work on a study program is the final instrument for checking whether the student has achieved the goals and outcomes of that study program. Usually, the final paper can be given by any teacher who given a course within that study program. Often there is no final work in the curricula of basic studies (mathematics), but the student completes the studies by passing all mandatory exams and winning the required 180 points for three-year basic studies or 240 points for four-year basic studies. Master's thesis is a mandatory final thesis in master's studies. A student usually chooses to work a master's thesis under of supervision of a teacher whose lectures were close and interesting to him. When a teacher assigns a topic to a student for a master's thesis and gives instructions for processing the topic, it is important to be aware of how much ECTS credits that paper carries within the study program (equivalent to information on how long a student is expected to complete). For example, if a master's thesis carries 30 ECTS, it is envisaged that it is done during one semester. In addition to the subject competencies, during the preparation of the master's thesis, the student acquires other general competencies, learns how to use literature, how to formulate and process the text and the like. It is especially important for the student (if he/she has not had the opportunity so far) to get acquainted with what plagiarism is, to learn that it is necessary to formulate the work independently and to take care not to directly include whole parts (or sentences) of some previous work.

Within the study program, it is defined whether the master's thesis is graded or not and whether that grade is taken within the average grade or not. If the master's thesis is evaluated, the commission should take into account the extent to which the master's thesis demonstrates that the student has achieved the goals and outcomes of the study program.

Self-evaluation

There is a possibility for the teacher to make tests by which students could independently assess their achievement of the goals and outcomes of the subject (for example, this test would help students to assess whether they have mastered the subject and are ready for an exam or some prior knowledge test). This test could be delivered by the teacher to the students or posted on the subject web site or other appropriate place through which the students and teachers exchange materials.

Evaluation

When it is determined that the student has achieved the objectives of the course and achieved the outcomes, then he takes the exam. Usually, in colloquia, tests and other evaluation instruments, the student (who has passed the exam) has achieved a certain number of points between 51 and 100 and that number defines a grade from 6 to 10 in advance according to the relevant university and faculty regulations. During the evaluation, the following evaluation principles must be met:

The principles of evaluation are

1) objectivity in evaluation according to established criteria;

2) relevance of assessment;

3) use of various assessment techniques and methods;

4) fairness in evaluation;

5) regularity and timeliness in assessment;

6) evaluation without discrimination and separation on any basis;

7) respect for the current conditions in which the assessment takes place.

Formative assessment

Formative assessment is the regular and planned collection of relevant data on student progress, achievement of prescribed outcomes and goals and the achieved level of development of student competencies. It is an integral part of the teaching and learning process and contains feedback to the teacher for further creation learning process and recommendations to the student for further progress and is recorded in the teacher's documentation. Based on the data collected by formative assessment, the student received a certain number of points, which is added to the number of points achieved in the exam. Formative assessment is recommended for relatively small groups of students.

Summative assessment

Summative assessment is the evaluation of student achievement at the end of the exam within the exam deadlines. The summative assessment gives grades that are numerical (from 6 to 10 if the student has achieved goals and outcomes), which depend on the total number of points earned by the student during the semester and on the exam.

Descriptive assessment

Descriptive assessment is relevant mainly in the recommendations that teachers write to students upon request, and they list the descriptive characteristics of the student, the assessed ability of students to continue their education and the like. Recommendations are needed by students for employment, scholarships, student awards, continuing education and similar.

Possible grading errors

1. Personal approach (too strict, too mild)

2. Halo effect (influence of previous information)

3. Giving higher grades so that the students has a higher average

Knowledge verification through the internet

The classic way of organizing exams for mathematics students in Serbia is a written exam in which tasks are typically done, and after passing the written exam, the student takes an oral exam, where it is checked how the student has learned the theory. The written exam usually lasts 3 to 4 hours, depending on the university, and students usually solve non-standard tasks that have not been previously done in exercise-classes. Around 2005, ie. until the adoption of the Bologna Declaration, most exams were two-semester and were taken at the end of the second semester by doing assignments in all areas covered by the exam and then taking a theory-exam that contained whole material from two semesters. Eventually, there would be an optional colloquium that gave additional points. After 2005, the exams were mostly divided into smaller units and were mostly one-semester. In addition, taking exams in parts has come to life. In some subjects, the entire material is divided into parts and is taken that way, while in others the exam is still taken only as a whole, because the teachers claim that this is the only way to check whether students understand the essence of that subject.

The order of holding the written and oral part of the exam is, as a rule, first the written exam, and then the oral exam, although it is necessary to know the theory before doing the tasks. Because of that order, first written and then oral, some students tend to get acquainted with the theory only as much as they need to do the tasks, which often means without a complete understanding of the subject. This is especially true for students who do not have ambitions to get higher grades on the exam. So, perhaps it could be considered to reverse the order of holding the parts of the exam: to master the theory first, and then apply it in the tasks (and usually this order is used to teach: first lectures, then exercises in which the theory which is adopted in lectures is applied). So students could first examine how deep they have gone into the theory, and then they would solve problems that use that theory and thus demonstrate the use of the theory adopted.

In the accreditation materials of the study program of basic studies MATHEMATICS at one university in Serbia (probably at most universities that have such a study program) it was pointed out that this study program with its teaching contents, as well as forms and methods of teaching enables students to acquire basic mathematical knowledge and understand the application of mathematical knowledge in practice. Also, by mastering the study program MATHEMATICS, the student acquires the ability to think logically, formulate assumptions and draw conclusions in a formal or formalized way. Therefore, with this study program, the student is expected to acquire basic mathematical knowledge and the application of that knowledge in practice. It is especially emphasized that the ability of abstraction and logical thinking is acquired.

The description of general and subject-specific competencies of students states that a mathematician who completes the study program Mathematics will be able to solve all basic types of

mathematical problems and tasks that include dealing with real and complex functions, topological, algebraic and combinatorial structures, geometric objects and configurations. probability spaces, and (exact) solving of basic types of differential equations and basic numerical problems. In addition, it is stated that the graduate student will be able to systematically and clearly reinterpret the most important theoretical assumptions from these areas and to apply them in modeling simpler situations from practice.

The learning outcomes of the entire program state that the successful student will, after graduation, gain a basic understanding of the system of mathematical disciplines and the relations between them, and essentially understand the basic concepts and results of the basic branches of mathematics. This knowledge will enable the successful adoption of more complex and sophisticated mathematical content, as well as the application of acquired knowledge, and independent nurturing and improvement of the considered mathematical theories. It is also stated that students will, after successfully completing these basic studies, have an insight into the concepts and acquire basic knowledge of the most important disciplines of theoretical and (depending on the choice of subject) applied mathematics. This will be a prerequisite for further successful mastering of specific areas of theoretical and applied mathematics, after which complete knowledge is acquired at the academic level (master). In addition, the student will be able to apply the acquired knowledge in practice, using the techniques he/she has mastered, making basic mathematical models.

Looking at individual subjects, the objectives of the course are formulated mainly as "learning" some theoretical things and mastering some techniques. Course outcomes are often formulated in such a way that the outcome is that the student will master a certain mathematical area, with the ability to creatively solve problems and understand the connections of the presented material with other areas of mathematics. Sometimes the outcomes of a subject are defined as minimal and desirable. If a minimal outcome is achieved, then the student receives a passing but lower grade, and if a "desirable" outcome is achieved, the candidate will get a higher grade.

For example, for the course of Boolean algebra and functions in the program of basic studies of Mathematics, the goal of the course is defined as follows:

Introduction to Boolean algebras and functions as a mathematical basis of digital technology and in that sense mastering the techniques of optimization of Boolean terms and functions.

The outcomes of the course are defined as follows:

Minimum: After completing the course the student should know and understand the finite ordered structures, especially Boolean algebra and that he/she is familiar with the corresponding language. He/she should have a clear role of Boolean terms or functions in digital technology, understand the reason and meaning of minimization and know the appropriate algebraic techniques.

Desirable: More detailed knowledge of ordered structures, ordered sets, distributive and Boolean lattices and the representation theorems. Good command of Boolean terms and identities, and ability to solve more complex minimization problems.

Therefore, during the evaluation, the teacher should check whether the student has adopted the appropriate knowledge and achieved the necessary outcomes of the subject and whether he/she has achieved only minimal outcomes, or also desirable outcomes, and therefore, whether the student is a candidate for a higher grade.

Furthermore, in the appropriate sheet with the description of that subject, it is stated that the adoption of the material is monitored through two colloquia and that in the oral part of the exam the student shows a comprehensive understanding of the presented material, in answers to theoretical questions and solutions. It is also defined that colloquia are worth 60 points, and the oral exam 40 points (a total of 100), which means that a student can pass the exam only with 51 points won in the colloquia without taking the oral exam. Thus, colloquia should measure through assignments whether minimum outcomes have been achieved. After passing the colloquia (winning at least 30 out of a total of 60 points), the student takes an oral exam and the teacher checks whether the student has achieved sufficient knowledge and understanding of the subject.

The question is whether it is possible to check the adoption of learning outcomes online?

As for giving colloquia for students to solve at home and send solved tasks, there is a possibility for students to share solutions among themselves and it is not possible to determine with certainty whether a student did the task himself or she/he copied from a colleague.

One possibility that arises in this context is to assign tasks and to monitor students as they solve tasks via the web-camera. Here, too, it can be suspected that the student has authentically solved the tasks, because there are various possibilities how the students can copy the tasks from others (from technical aids like bugs to "helpers" that would be present outside the scope of the camera.)

One possibility is to assign different tasks to each student, which would be possible if there are not many students in the group. So, each student does their homework, and time is limited and students work so that their camera is turned on. When the time expires, then the students take pictures of the completed assignments and immediately submit them to the teacher or place them on the appropriate platform.

Also, it is possible to quickly check the knowledge of terms (quick test with multiple answers) in which students receive various permutations of answers to questions from which the correct answer is in different positions in different students.

A realistic option is also oral communication in which one communicates with the student all the time using a microphone and a camera. In that variant, students are examined one by one, The teacher communicates directly with the student using a microphone and a camera. It is good to allow students to use a book or notebook, and after receiving a topic on which a discussion will be organized, they can be allowed to think about the topic for a few minutes. After that, they are asked a series of quick questions in order to establish how much the students understood and learned the topic.

As a rule, it is more difficult for students if the use of literature is allowed, because then the questions are usually more difficult and they are asked to show understanding, and not just the learned material without deep understanding.

For example, for the mentioned course Boolean algebra and functions in the undergraduate program of Mathematics, some of the questions that can be asked for a student to show understanding are the following:

1. From the topic Ordered set, the following questions could be asked:

- Is there a relation that is at the same time an equivalence relation and an order relation, and if so, what would be the relation?

- Is the covering relation reflexive, symmetric, antisymmetric, transitive ...?

- Give example of an ordered set that is not linear.

- Can the covering relation be empty and if so, in which ordered set it is the case?

- Can the covering relation for two different ordered sets be the same?

- Can a subset of an ordered set be both a chain and an anti-chain?

- Give examples of semi-filters and semi-ideals of an ordered set of natural numbers ordered with the relation "divide"

- Do finite isomorphic ordered sets have to have the same number of elements?

- Is there an element that is both minimal and maximal?

- Explain the relationship between the smallest, largest, minimum and maximum elements.

Some of these questions are quite simple and every student who has met the minimum outcome should know it, and others measure the achievement of the desired outcome, for a higher grade.

Let's say the question of whether the covering relations of two different ordered sets can be the same contains several "traps". The first thing is that if two relations are the same then they are on the same set, so the carrier set of those two ordered sets must be the same. And second, the relations must be the same as a set of ordered pairs. If students know the answer to the question that the covering relation can be an empty set, they will probably try to find an example so that the covering relation is an empty set. And if they remember that the carrier must be the same, and if they realize that it must be infinite, they will probably remember some simple example, such as the set of real numbers with the relation less and equal and then the same set with the relation equal (chain and anti-chain), but in both cases the covering relation is the same: empty relation ...

This is an example when seemingly simple questions can be used to measure understanding the subject and of achieved outcomes, and this can also be done online, precisely because the questions are short and simple and do not have many technical details.

In this course, it is also convenient to ask questions to draw a lattice with the given characteristics, and then the student can draw it and show it directly to the teacher.

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QUESTIONS:

How to enable students to make a transition from passive listeners to active participants in the learning process?

How to actively engaged students to progress from memorizing facts to understanding, analyzing, and applying concepts to various problem-solving tasks?

How to incorporate transfer of learning and pattern recognition in class activities?

Ask, Don't Tell!
Techniques to Promote Interactive Teaching and Learning with Understanding

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Contents

Introduction

The imperative of contemporary higher education should be to enable students develop into independent learners. ***Asking*** students to recall, explain, analyze, apply and evaluate existing knowledge in place of simply *(re)****telling*** them what is already contained in textbooks or other readily available sources of information is a feat that requires a significant effort on part of instructors to change the way they use valuable but limited lecture time. There are numerous types of in-class activities that allow students to actively interact with the material and learn with understanding as oppose to simply memorizing facts. The sessions of traditional lecturing lasting 5 to 10 minutes may be used to connect the adjacent in-class activities and provide additional explanations and/or summaries of perplexing topics and concepts.

Several straightforward pieces of advice described below can serve as useful tools for helping students cultivate the aforementioned higher-order thinking skills and facilitate their transition from novices to experts in their fields of interests.

Instruct students to prepare in advance

Lecture time is limited and therefore should not be wasted on repeating definitions and relatively simple statements from textbooks. It seems especially superfluous to spend considerable chunk of lecture time on revisiting the knowledge university students needed to have acquired in order to pass entrance tests. However, the revision of basic knowledge is necessary in order to move on to more complex topics and concepts.

One strategy a lecturer can resort is to hold students responsible for acquiring the basic knowledge on their own before coming to class. In other words, before each class, students should be instructed to read an appropriate chapter from the chosen textbook and answer 10 – 15 basic homework questions related to the day's lecture topic. The purpose of this preparation is to enable students to make a transition from passive listeners to active participants in the learning process. The potential student resistance to investing time in pre-class activities can be overcome by grading homework for completion and/or correctness and making this activity account for up to 10% of the final grade.

Use diverse in-class activities

The use of diverse teaching techniques is a crucial step to get students actively engaged with the material and enable them to progress from memorizing facts to understanding, analyzing, and applying concepts to various problem-solving tasks. Here we list several in-class activities that can be easily adapted to different disciplines (e.g., natural sciences, humanities and social sciences, etc.).

Open-ended questions on unsigned index cards. It is well known that the fear of speaking in public and/or embarrassing oneself by giving a wrong answer in front of one's peers is a major obstacle to creating interactive learning environment and by extension uncovering students' misconceptions in a timely manner (Silverthorn 2002). This adversity can be avoided by instructing students to succinctly answer an open-ended question (e.g. *How does body regulate blood pressure?*) on an unsigned index card. The index cards are then collected and randomly redistributed throughout the class so that each student receives someone else's anonymous answer. Students are given some time to discuss answers among themselves before being asked to read out loud the answer they ended up receiving. In this setting students are more willing to openly discuss answers with the rest of the class whether they are correct or not because they are not held accountable for correctness. This is an example of an in-class activity designed to help students integrate their knowledge, to facilitate communication among student, and at the same time to allow a lecturer to uncover any misconceptions in real time.

Multiple-choice questions (MCQs). Multiple-choice questions are an example of in-class activity that can significantly vary in its complexity. This type of questions can be used regularly throughout the semester to test not only basic knowledge (e.g. terminology, definitions, etc.), but the ability of students to integrate smaller pieces of information into a so-called "bigger picture".

The students' responses can be polled by using either electronic student response systems (e.g. iClickers) or one of the smart phone polling applications (e.g. SurveyMonkey, Socrative, etc.). In the absence of access to electronic student response systems, a much simpler but equally effective approach may be taken. Namely, each student can be provided with a set of different colored cards with letters on them (A, B, C, D or E). Students reply to questions by raising up the card with a letter which in their opinion corresponds to the correct answer choice within the MCQ. The different colors allow lecturer to quickly interpret the majority response.

Multiple-choice questions can be used either at the beginning of each class to test the recall of the previously covered material or later in the lecture to test comprehension of the material taught during the ongoing class. In this regard, MCQs may be another invaluable tool for efficiently uncovering misconceptions. Moreover, MCQs can be used not only as a testing tool but as a learning tool as well. Having students rephrase incorrect answer choices into correct statements can help them fill in the gaps in their knowledge.

Unless MCQs are targeted at testing one of the more perplexing concepts, most of the students respond correctly while the others usually choose one of the wrong answer choices. However, there are occasions when a majority of students choose the same wrong answer. Instead of immediately jumping to clear out the misconception, a lecturer can resort to a "talk to your neighbors" technique, more formally known as think-pair-share (Lyman 1981). This particular technique allows students to correct their misconceptions by discussing them with their peers. The efficiency of this approach is regularly

proved in the classroom setting since the percentage of the students who correctly answer the question is usually significantly increased after they had a chance to have a brief discussion with their neighbors. Making room for peer-to-peer teaching also showed that the success of interactive teaching depends not only on communication between the teacher and students but on communication among the students as well.

The benefits of peer-to-peer teaching can be maximized by exposing students to the influences of as many different ways of reasoning as possible. The usual tendency of students to always sit next to their classmates they prefer for socializing outside the classroom may be counteracted by "shuffling", that is occasionally instructing them to sit next to people who, for example, were born the same month or whose first names begin with the same letter. The use of these random criteria facilities students' getting in touch with more peers than they would normally interact with and helps them learn how to work more effectively in a team.

The complexity of MCQs as a testing tool can be increased by varying the number of correct answers. One approach is that there is always one correct answer. However, students may be instructed to circle *all* of the correct answer choices. In this case the number of correct answer choices may vary from zero to all of the offered. In this case, full credit is received only by circling each correct answer choice and leaving un-circled each incorrect answer choice. Partial credit is received in case a student circles one or more incorrect options or if he or she fails to circle one or more of the correct statements.

Concept maps and graphs. Mapping is a non-linear way of organizing material. It is based on the theory that each person has a unique cognitive organization of previously learned material (Daley 2010, Fonseca 2020). New learning occurs when students are able to attach new ideas to this preexisting framework. A map can take a variety of forms but usually consists of terms linked by explanatory arrows. The map may include diagrams or figures. The connecting arrows can be labeled to explain the type of linkage between the terms (structure/function, cause/effect) or may be labeled with explanatory phrases (i.e. "is composed of").

The real benefit from using maps occurs when students prepare maps from scratch. By presenting the material in the form of a concept map, students are prompted to question the relationships between terms, organize concepts into a hierarchical structure, and look for similarities and differences between items. Interacting with the material in this way ensures that learners process covered topics into long-term memory instead of simply memorizing it for a test.

The efficacy of maps can be additionally increased by the consistent use of colors and shapes. Namely, numerous studies in learning theories have confirmed that consistency in color and shape in graphics triggers pattern recognition in the viewer and improves memory performance (Kuhbandner 2013).

Here is the list of instructions a lecturer can give to students to facilitate their progress in map-making:

1. Choose the topic to map.

2. Select the words and concepts related to the topic. Judge the relative importance of each one.

3. Arrange the concepts in an organized fashion. Begin with the most general, important, or overriding from which all the others naturally stem.

4. Arrange the concepts from most general at the top to most specific at the bottom, or follow the passage of time from beginning to end. The downward development of the map will generally mean the passage of time or an increase in complexity.

5. Decide what the association is between two terms. Does A cause B (cause-effect)? Is B a sub-part or subtopic of A (part-type)? Is it a characteristic or descriptor of A? Use arrows point the direction of the linkage. By convention A → B means that A causes or has an effect on B, or B is a component of A.

To illustrate the efficacy of concept maps as a teaching/learning tool, we will use the map which depicts integrating body's response to severe dehydration (Fig. 1). This topic is traditionally difficult for physiology students to grasp because it requires the ability to consolidate information from mentally compartmentalized organ systems discussed over the course of an entire semester. However, graphical presentations of interlocking processes enables quicker and more efficient comprehension of the material despite its complexity. For example, even a reader who is not an expert in physiology would be able to relatively easily answer "What is the role of angiotensin II in severe dehydration?" simply by looking at the map (answers: acts on cardiovascular control system in the brain, constricts arterioles, stimulates vasopressin secretion, promotes thirst). Alternately, if the same reader were asked to answer the same question by reading a paragraph which contains the same amount of information as the aforementioned concept map, the process of reaching the correct answers would be more arduous and time-consuming.

Further development of higher-order thinking skills (e.g., applying, analyzing, evaluating), and by extension a more meaningful interaction with the material can be accomplished by either having students interpret graphs and charts in different formats or instructing them to present data sets in the form of graphs. The students should be instructed to begin the graph analysis by identifying independent variable and dependent variable and then to verbally describe the information contained in the graph. Alternately, students can be required to convert textual descriptions of data into graphs.

Compare and contrast. Learning with understanding can be enhanced by using the "compare and contrast" type of tasks. The research within the field of perceptual and conceptual learning has shown that appropriately arranged contrasts can help students notice new features that previously escaped their attention and learn which features are relevant or irrelevant to a particular concept (Schwartz 1999). This type of task is suitable for teaching concepts related to various scientific disciplines such as mathematics (linear v. nonlinear functions), psychology (recognition memory v. free recall), physiology (anatomical and functional features of sympathetic v. parasympathetic system), etc.

Quantitative problems. The use of tasks based on calculations and solving equations is suitable for teaching mathematics, physics and chemistry, as well as different biological disciplines, such as physiology and genetics. This kind of task lends itself well not only to testing students knowledge, but helping them develop self-confidence as well. For example, some quantitative activities requiring the use of equations may be designed to contain excess data that is not needed for the calculations. In this case, students first ought to display the ability of eliminating pieces of information irrelevant to solving a particular problem and subsequently use the remaining ones to reach the correct answer. Alternately, students can be presented with tasks in which they need to recognize that they are given insufficient information to reach the correct answer. The purpose of these interventions is to

desensitize students to being taken out of their comfort zones as well as to mimic real-world situations in which there may be too much or too little information to solve a problem.

Incorporate transfer of learning and pattern recognition in your in-class activities.

The overarching goal of modern education is to enable students to apply what they learned in one context to new contexts. This skill is called transfer of learning. For example, the comprehension of fluid dynamics often taught within introductory physics courses should ideally facilitate understanding the principles governing blood flow and resistance to blood flow covered in physiology courses. Similarly, complex systems principles such as positive and negative feedback loops are applied in biology, chemistry, physics, economics, geology, and even social sciences.

However, research has shown that students seldom spontaneously transfer what they have learned across seemingly unrelated scientific disciplines/contexts. The transfer of knowledge can be fostered by employing teaching techniques aimed at training flexible thinking. One way to increasing flexibility is to ask students to solve a specific case and then provide them with a similar one. The goal of this exercise is to help them extract general principles that lead to more flexible transfer of knowledge. An alternate approach is to generalize the case so that learners are asked to create a solution that applies not simply to one particular problem, but to a whole class of related problems.

A skill that sets experts apart from novices is the ability to recognize patterns, consciously or unconsciously (Bransford 2000). Patterns are one way to recode separate pieces of information into 'chunks'. Limited bits of information a person can process at one time can be expanded by 'chunking' them together – that is to say by contextualizing them. Expertise is then developed by deliberate practice with multiple specific examples representing the underlying pattern (Norman 2005). Conscious or subconscious pattern recognition, a form of non-analytical thinking, is now recognized as an important component of clinical reasoning (Norman 2007) and is therefore a skill teachers should aim to develop in their students.

For example, we witnessed in our introductory physiology class that frequent reinforcement of basic reflex patterns throughout course resulted in pattern recognition which ultimately improved students' ability to transfer the principles of homeostasis to unfamiliar situations (i.e., physiological process not directly covered in class). In the hindsight, a better understanding of homeostatic mechanisms helped students deconstruct and comprehend both normal and abnormal physiological scenarios.

In conclusion, previously described learning theories and teaching techniques represent a framework that can promote interactive teaching and learning with understanding. These approaches are widely applicable, unrestricted to a specific scientific discipline, and can be used by educators and/or learners to cultivate innovation and progress.

FIGURE LEGENDS
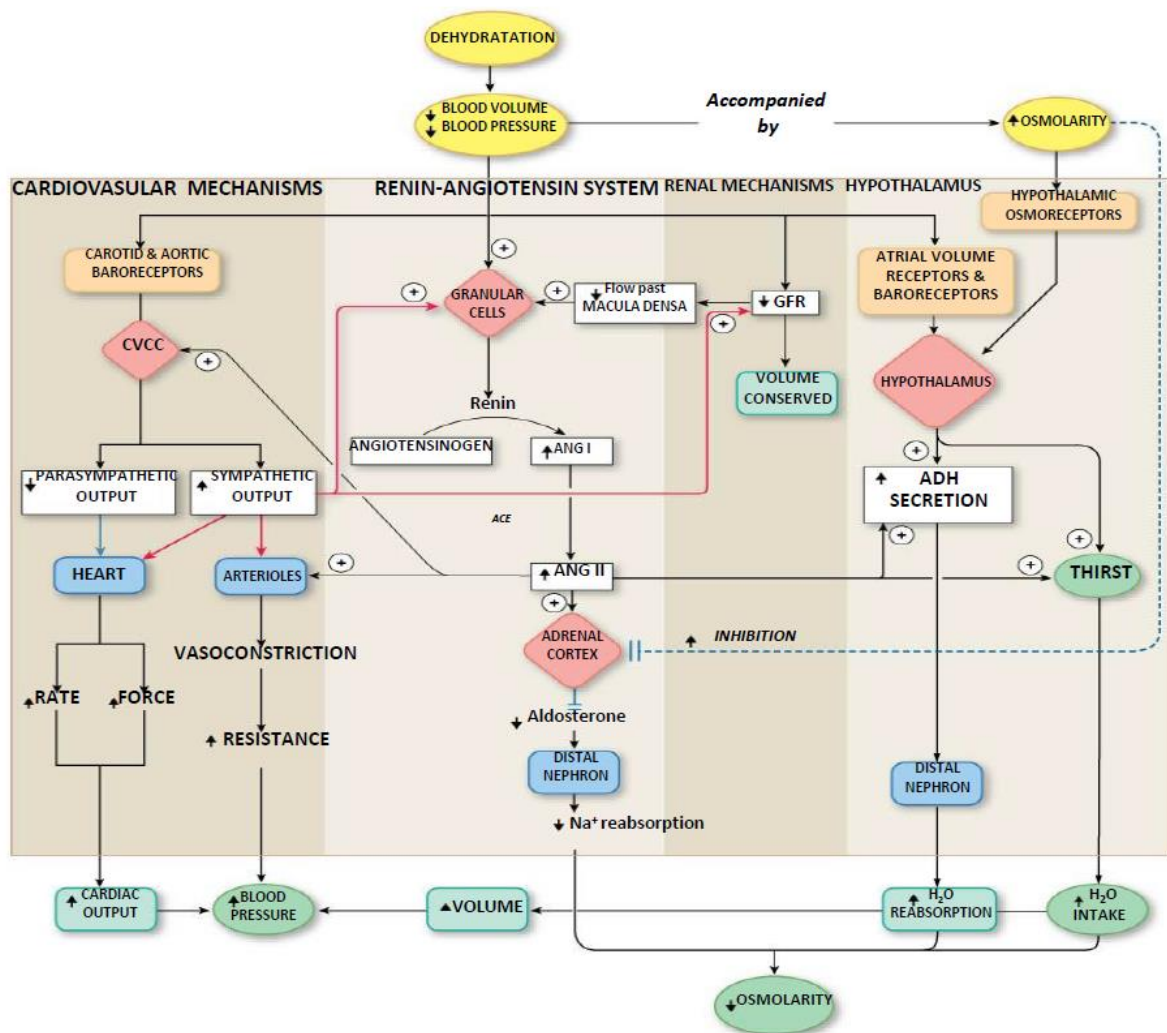
4   Figure 1. Integrated response of human body to severe dehydration. Adapted from "*Human Physiology: An Integrated Approach (6th Ed)*" by Dee Silverthorn

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QUESTIONS:

What are the features and functions of pedagogical communication?

What types of communication are important for the teaching process?

How to can effective communication be established in the classroom?

What is interaction in classroom communication?

How can active listening be encouraged?

How can conflicts be resolved constructively?

Effective pedagogical communication in higher education
How to communicate in class?

Contents

Introduction

Teaching process is a specific communication context whose characteristics determine its ways of realization, quality and efficiency.

The preconditions for successful communication in the classroom are, first of all, highly developed knowledge about pedagogical communication, communication skills of all participants in the education process and teacher competencies for an efficient didactic and methodological modelling in teaching. The field of competencies for didactic and methodological modelling implies the modern view of the teaching process, its organization, applied didactic teaching methods, set goals and objectives, guiding principles, methods and forms of teaching. The process of modernization and improvement of classroom communication is therefore conditioned by the process of improvement and modernization of the entire teaching process and only proper understanding of this mutual connection between the teaching and communication within it provides an opportunity to achieve the defined goals and objectives.

Given that the main goal of teaching is the acquisition of knowledge and the development of abilities, skills and habits, the entire classroom communication can be defined as a very complex and subtle process. The complexity and subtlety of this process is reflected in the need for all communication procedures to be based on the ability of students to accept, interpret, adopt and adequately respond to the message communicated. Compliance with the psycho-physical and intellectual abilities of students, clarity and reciprocity, i.e., two-way communication, are the main preconditions for successful realization of classroom communication.

Since students are participants in the teaching process, they are both the necessity and the precondition of a successful educational process, to which all its participants must equally aspire. Based on this, and considering the specifics of the communication process, it can be said that the efficiency of classroom communication largely depends on the ability and skill of the teacher to turn the student into an active participant in educational activities. This active role implies that he/she is active and creative in the preparation, implementation and evaluation of teaching. More intensive participation in classroom communication results in greater independence and creativity, development of creativity, skills, self-realization and self-actualization of students, as well as the development of other pedagogical values that modern teaching strives to achieve.

The most complex and most difficult task of classroom communication in higher education, which the efficiency of teaching depends on, is to elicit active behaviour. In order to achieve this, it is necessary to have highly motivated students, which is, above all, achieved by using those teaching methods and tools by which they are encouraged to participate in learning activities. In that sense, communication in the classroom must be qualitatively didactically and methodologically organized, to necessarily lead to intensive and active acquisition of knowledge and development of competencies.

Adequate, appropriate and efficient classroom communication is more than half the success. As important as it is for the teacher to know the learning material, it is also important, even more, for the teacher to convey or interpret that material with the help of proper communication. Pedagogical communication as a factor of teaching efficiency must respect the basic standards on the basis of which the entire educational process is based, among which the principles of clarity, completeness, conciseness, concreteness and accuracy stand out. This means that if we want effective communication in the classroom, we must clearly and understandably present and talk, we must take into account the temporal and content integrity of the statement, highlight the basis of the presented content, base the entire presentation on specificity and accuracy.

Modern higher education, whether we want to admit it or not, is still characterized by insufficiently efficient communication characterized by passive position of students, poor quality and mostly one-way communication, and many other features that are obstacles to the process of modernizing and improving its efficiency. This, of course, does not mean that no efforts are made to modernize, improve and make teaching and classroom communication more efficient. Everything that is being done for the purpose of studying pedagogical communication, regardless of whether it has a theoretical or empirical character, is an important contribution. Based on the positive achievements of pedagogical communication and extensive global experience in studying this problem, we must build a rich system of scientific knowledge that will enable us to make good-quality and efficient communication in teaching our reality. The role of teachers-practitioners at all levels of education is very important because they are the direct implementers of change. With their orientation towards

modern interactive models of communication and competencies for efficient application of different types and techniques of classroom communication, teachers ensure the good quality of the teaching process, develop communication skills in their students and prepare them to be active creators of future communication models. For that reason, the material aims to provide teachers and associates in higher education institutions with basic modern knowledge in this field and to develop effective classroom communication skills.

Pedagogical communication

The term "communication" is derived from the Latin term *communication*, which means conveying, imparting, presenting, togetherness. The etymology of this term refers to interaction, the cooperation between individuals in the realization of a common goal.

Pedagogical communication is an extremely important activity by which the transmission, reception and exchange of social values and experiential achievements is performed through symbols. It is "the exchange of meanings, the exchange of experiences, the transmission of social values, the transmission, or transmission and reception of information, signals or messages through gestures, words or other symbols" (Mijanović, 2004, 256).

The essence of pedagogical communication is the adequate use of communication symbols and signs in communication, which prevents the occurrence of errors and misunderstanding, and ensures successful communication. From the andragogical-psychological aspect, "communication implies different forms of communication between people. In the educational process, communication assumes that both teachers and students understand communication signs and symbols, which is an important prerequisite for their equal and creative cooperation, and also overall success in teaching and learning" (Kulić, 2004, 194).

Classroom communication implies the transfer, reception, analysis of necessary information and action in accordance with them, all for the purposes of achieving educational goals and objectives. It not only allows for the exchange of information, but also ensures for the attitudes, interests, desires, ideas, emotions to be conveyed, received and exchanged, and allows for a spiritual and cultural contact among participants.

The main elements of classroom communication are: source of communication-sender, receiver, message, communication channels and feedback. In addition to these communication terms, in order to have the correct and more complete definition of pedagogical communication, it is also necessary to define the terms communication skills, noise, signals, encoding and decoding.

Source of communication, that is, the sender or transmitter can be a teacher or a textbook. "The source that sends the message (teacher) encrypts the thought, i.e. determines the data to be sent. This process is called message encoding. Encoding will depend on the skills, attitudes and knowledge of teachers" (Stevanović, 2004, 90).

Recipient in classroom communication is the student to whom the message is addressed. He deciphers the received message, that is, he translates it into a form that he understands. In order to correctly decipher the received message, the recipient must be skilled in listening or reading.

Message is a statement that contains information that is sent through the communication process.

Channel is the path a message travels. It is determined by the source of the message and can be direct (speech, text, gesture) and indirect (through an intermediary).

With *feedback,* the sender checks how the recipient understood the message. Feedback is particularly significant for the teaching process because through it we are informed about the students' progress. It gives us the necessary information to control, correct and regulate the teaching process and provides motivation to both students and teachers for new commitment and effort.

Noise is anything that interferes with the proper flow of information and can cause reception errors. These are most often noise, quiet tone of voice, shouting, insufficiently legible text, slurred speech, etc.

Signals are creations through which information is transmitted.

Communication skills implies the ability to adapt to various communication situations. It also includes knowledge, traits and communication habits.

Encoding is a cognitive thought process of transforming ideas and feelings into symbols and organizing them in the form of a statement.

Decoding is the reverse process of transforming a message into ideas and feelings.

Being aware of the main features and elements of classroom communication allows teachers to properly plan, organize and interpret communication and ensure its effective implementation in everyday teaching process.

–Functions of pedagogical communication

Higher education context is characterized by specific communication which is conditioned primarily by adulthood, i.e., enviable level of maturity of its participants (students and teachers). This particularity of higher education communication imposes numerous challenges on teachers to fulfil the requirements and functions that adult participants in this communication demand. The main functions that higher education classroom communication should perform are: cognitive, emotional, normative and actualizing function.

All these functions are interconnected and mutually conditioned, and it is necessary to study them in their dialectical unity. In order to better understand each of these functions, we will present their most important characteristics.

Cognitive function of classroom communication is the basis for the realization of all its other functions. In classroom communication, students, in accordance with their individual abilities and interests, acquire the knowledge they need to be actively involved in the real world. The very process of acquiring knowledge, as well as the facts and generalizations that are reached through this process, are not the only objective. They are a tool for personality development. In addition to the acquisition of knowledge, the cognitive function includes the development of intellectual abilities, skills and habits, development of interest in learning, motivation for self-education, improvement of intellectual activity etc., which is especially important for future academic citizens.

Emotional function of classroom communication is reflected in the improvement and development of the overall emotional state of students and is realized both in teacher-student communication and in student-student communication. For that reason, it is important to ensure that classroom communication is characterized by a positive, stimulating atmosphere dominated by a sense of trust, honesty, understanding, satisfaction, mutual cooperation, etc.

Normative function of classroom communication refers to providing adequate psychosocial and other conditions for understanding and accepting the rules, norms and values of socially acceptable behaviour. This function of pedagogical communication is very important, because it covers the area of socialization and socio-moral development of young people. Thanks to this function, students are enabled to develop their social identity, understand and comprehend the meaning and significance of their responsibilities, duties and positions in the group and the social community to which they belong.

Actualizing function of classroom communication is aimed at creating opportunities for self-realization of students in the classroom. It involves creating opportunities for students to express their views, skills, potential, and creativity. This function therefore creates conditions for students to realize their personality, to confirm, prove and self-realize.

As we have already mentioned, any exclusivity and one-sidedness in favouring one of the abovementioned functions is unacceptable and teachers must always keep in mind that the communication process, according to the specifics of the set goal, should be directed towards achieving as many functions as possible.

Types of pedagogical communication

In the didactic and communicology literature we find numerous classifications of communication, which primarily depends on the preference of certain criteria which the classification process starts from. The most detailed classification of communication is as follows: (1) based on the number of participants - interpersonal, intrapersonal communication and mass communication; (2) based on the nature of the main medium of communication - personal and apersonal communication; (3) based on the manner of communication - verbal and non-verbal communication; (4) based on the direction of communication - one-way and two-way communication; (5) based on the nature of communication relations between communication participants - authoritarian and democratic communication; (6) based on the quality of communication - plus, adequate, zero, minus communication, anti-communication; (7) based on the distance between the participants in the communication process - direct communication and long-distance communication (telecommunication); (8) based on the nature of behaviour in a conflict situation - violent and non-violent communication.

–Interpersonal, intrapersonal and mass communication

Interpersonal classroom communication implies communication between two or more people "face to face", or communication between two people through an impersonal medium (letter, telephone, etc.). In the didactic sense, interpersonal communication is an interaction in which one person presents certain content in order to influence the personality of the person with whom he/she communicates.

The main characteristics of successful interpersonal communication are: 1) "Interpersonal communication includes verbal as well as non-verbal behaviour; 2) Interpersonal communication includes spontaneous, practiced and planned behaviour, or some combination thereof; 3) Interpersonal communication is not static but developmental; 4) Interpersonal communication includes personal feedback, interaction and coherence; 5) Interpersonal communication takes place in accordance with some internal and external rules; 6) Interpersonal communication is an activity; 7) Interpersonal communication can involve beliefs or persuasion" (Reardon, 2008, 20).

These characteristics are important for the teaching process itself and it is necessary to emphasize that classroom communication is and must be interpersonal communication.

Intrapersonal communication is the internal, personal communication of a person with oneself, that is, "speaking to oneself". It is also called inner speech because it represents an introspection of one's own attitudes, abilities or behaviour. This communication is referred to as "monoaction". Intrapersonal communication, i.e., internal speech, precedes any interpersonal communication and is of special importance for the process of self-assessment or self-evaluation. In didactics, this type of communication is seen as stimulating silence and great importance is given to it because it precedes other types of communication that are assessed as better if it precedes them.

Mass communication is a specific type of pedagogical communication, which originated as a consequence of modern achievements of educational and information technology and mass media. Mass communication is aimed at a wide and heterogeneous group of students, and because of its publicity often includes a population that is outside the organized forms of teaching. The application of mass communication in teaching is of great importance and takes place by recording radio and TV shows, panel discussions etc. which can be watched by students at the desired time.

– Verbal and nonverbal communication

Verbal communication is based on articulated human speech, whether it is done directly through a lecture or conversation or with the help of some medium through which it is transmitted (microfilm, computer, etc.). It plays a significant role in teaching, provided that it is didactically shaped and that it is aligned with the main educational laws. Since it is based on language as the most important communication system, verbal communication can be oral or written, which makes it more applicable and important for the teaching process compared to other types of communication. Thanks to verbal communication, it is possible to inform students about objective views, about events and objects from the immediate reality, about ourselves, but also about subjective views, ideas, thoughts, desires, etc. Considering these features of verbal communication and the fact that it is under our conscious control, this type of communication was given great importance in pedagogical science. Given the importance other types of pedagogical communication have for the teaching process, modern pedagogical science is increasingly turning to them as well, primarily emphasizing their connection and dialectical unity with verbal communication.

The teacher as the leader of the teaching process must be well, both theoretically and practically, trained to use verbal communication. In order to use verbal communication to achieve all educational goals, it is necessary to keep in mind the various meanings of verbal communication. These are above all: formal, functional, affective and prototypical meaning of verbal communication.

Formal meaning of verbal communication is what a particular message means in terms of its formulation. It is a meaning that other people will always interpret in the same way, irrespective of how something is said or written. Formal meaning is of great use in the teaching process when different individuals understand a certain message differently, because it serves as a criterion for clarifying misunderstandings.

Prototype meaning implies the use of exemplars, examples, i.e., patterns on the basis of which a certain verbal statement serves to indicate a number of similar situations, cases, etc. "in which the same meaning can be recognized in the given circumstances".

Affective meaning of verbal communication refers to the emotional content that a certain verbal message has for the sender and recipient. In the teaching process, it may happen that there is no alignment between the emotional experience of the teacher and students.

Functional meaning of verbal communication indicates the practical aspect of the content we are talking about. In the teaching process, this meaning of verbal communication is given great importance because in order to achieve all educational goals, it is necessary to move from the formal to the functional level of acceptance of the material being taught.

Verbal communication in the classroom can be accompanied by a series of verbal obstacles, which significantly complicates both the communication process and the realization of the learning objectives. Fortunately, these barriers can be overcome or at least alleviated by nonverbal cues that accompany verbal communication. The verbal obstacles that most often appear in teaching are: fillers, confusing expressions, emotional words, ambiguities, speech defects, etc.

Fillers are expressions, words, neutral voices or syllables that often accompany verbal presentation by the speaker using them in places where they do not belong contextually. The most common fillers in teaching are: expressions - therefore, in that sense; words - meaning, I mean, otherwise, therefore; neutral voices and syllables - mmm, nnn, hmm, etc.

Confusing expressions are a consequence of inaccuracy of speech and occur due to slang speech, inappropriate metaphor or wrong pronunciation or emphasis.

Emotional words are those words that are often used in the classroom to evoke strong emotions, whether they are positive or negative, that is, pleasant or unpleasant emotions. They are often used to increase students' motivation for some activities that students rarely opt for.

Ambiguities are related to words and expressions that are spelled the same, but have different meanings depending on the context or pronunciation.

Speech defects often make pedagogical communication difficult, whether they come from teachers or students. The most common speech defects that make communication difficult in class are: stuttering, sigmatism, dyslalia, too quiet tone of voice, too loud speech, incorrect diction, etc.

Non-verbal communication is very often and completely unjustifiably given secondary importance in the teaching process. In support of the claim that such an attitude towards non-verbal communication is unjustified, it should certainly be noted that the realization of the main functions of verbal communication (which is seen as specifically important) is impossible without adequate non-verbal accompaniment. In the teaching process, non-verbal communication confirms, denies, expands,

changes or evaluates a verbally expressed message. Non-verbal communication expresses emotions, intentions, expectations, as well as attitudes towards the expressed messages in a direct and immediate way.

If we know that in the teaching process communication aims to make students unambiguously understand the educational message, as well as to accept it and act in accordance with it, and if we know that understanding the message is significantly influenced by the teacher's nonverbal behaviour that accompanies the message, this communication has to be focused on more. Teachers must always keep in mind and know that it is not only the spoken content that is important, but also the non-verbal behaviour that accompanies the message.

The main functions of non-verbal communication are: "expressing emotions, expressing mutual attitudes of persons in communication; presenting one's own characteristics; monitoring, supporting and supplementing verbal communication; substitute for verbal communication; conventional expression of various types of social activity "(Rot, 2004, 141).

For the correct use of non-verbal communication in teaching, it is necessary to know the basic channels through which it is implemented. The basic channels of non-verbal communication are: visual communication, facial expressions, body language, personal space, paralanguage, etc.

According to many authors, *visual communication* is the most important channel of non-verbal communication in teaching. It refers not only to looking and eye contact, but also to seeing useful and accessible non-verbal signs. Given that by looking at something, an individual sees and registers, accepts more available non-verbal signs, this process is extremely important in the teaching process. By seeing, students can therefore see non-verbal signs and signals that can greatly amplify, clarify or change the meaning of the verbal messages to which they are exposed.

Facial expression is also one of the important channels of non-verbal communication in teaching. By carefully observing facial expression, all participants in the education process can learn a lot about both the people and the events being discussed, and can very often recognize the basic emotions of the person whose face they are observing.

Body language as one of the channels of non-verbal communication includes the following signs: touch, body orientation, hand gestures and nodding. Each of the above signs is widely used in school, which speaks of their significance and breadth of their application.

Personal space represents the level of physical proximity that is allowed depending on the intimacy of the relationship with the person we are interacting with. The social context, sometimes written and sometimes unwritten rules, regulates the distance of the individual in the process of communication. In the classroom, the personal space of the pupil is determined, first of all, by the child, the individual abilities of the child, but also by the characteristics of his personality. In the younger grades, with students with lower intellectual abilities, the teacher is often forced to get closer to the student than usual. Of course, any other violation of students' personal space, any that is not aimed at achieving educational goals, is unacceptable and impermissible.

Paralanguage is a common name for pitch, accent, pauses, and timing, emotional tone of voice, accent, and speech errors such as stuttering, "aaa," "hm," and so on. The application of these paralinguistic aspects of speech in teaching is frequent and is used to emphasize the essentials, point

out differences or similarities, instruct students to think, turn a statement into a question, etc. Skilful use of paralanguage can be of great use in teaching, while improvisation of any kind can have extremely harmful consequences, so the education of teachers in this field is very important.

Verbal and non-verbal communication are, therefore, equally important for the of participants in the education process. The interpersonal relations depend on the way of communication that is realized in the teaching process, and the success of the realized communication and the entire teaching work depends on the realized relations.

−Personal and apersonal communication

Personal communication (lat. Persona, -ae = person, personality) is a form of communication in which two or more persons participate without any mediation. This communication in the classroom can take place in several ways. In the relation teacher-student, teacher-teacher, student-student, teacher-group, student-group, etc. Thanks to the fact that it takes place between the participants in the education process, directly, without intermediaries, it is rich in emotions, enables a rich exchange of opinions and attitudes, which is of special importance for the realization of teaching goals.

Apersonal communication is communication in which the basic media of communication are technical means, electronic devices, media systems, multimedia systems, etc. It is, therefore, communication mediated by some technical or impersonal medium. In modern models of organized instruction caused by the global epidemiological situation, this type of communication is of great importance, and it can be said that it has recently developed and improved even more.

Having in mind the pedagogical value of personal and apersonal communication, it can be concluded that these two types of communication in teaching should be combined and complemented in order for the outcome of teaching to be successful.

−One-way and two-way communication

Two-way communication implies communication that is based on the possibility of providing mutual feedback between participants. With feedback, the subject receiving the information responds to the information sent to him, thereby confirming the receipt and understanding of the information he has received. In the teaching process, the most intensive two-way communication is realized in the relationship between a teacher and one student or in the relationship between a teacher and a small group of students. In order to achieve intensive and good-quality two-way communication, the conversation method is often used in teaching.

One-way communication in the classroom is characteristic of traditional instruction and represents communication that should be overcome and replaced by two-way communication. The main feature of this communication is that it takes place in one direction, i.e., that the information during the communication flows only from one subject to another, i.e., to others, and not vice versa. The main feature of one-way communication is the absence of feedback. Although this type of communication has been criticized and is considered the most unfavourable for teaching, it is still the most dominant one in the modern school.

–Democratic and authoritarian communication

Authoritarian communication is characteristic of traditional teaching and followers of authoritarianism. It is characterized by giving strict instructions and orders, as well as one-way information and pre-determined and regulated course of communication. It represents communication from a hierarchical position and is characterized by a commanding tone, unconditional obedience, exclusion of desires, spontaneity and freedom. The student is in a subordinate position, without the right to freely express their needs and interests, and without the opportunity to actively participate in teaching.

Democratic communication is characteristic of modern teaching. It is based on collaboration, initiative and student activity. Equality of all participants in communication, the ability to express individual needs, desires and interests, and to take action in accordance with them is a feature of democratic communication. Democratic communication provides students with the opportunity to have and express their own opinions, express their views and communicate freely both with the teacher and with each other. This type of communication is often referred to as symmetrical-interactive communication, which means that the student can always address the teacher in the same way as the teacher does in communication with the student. By putting all participants on an equal footing, democratic communication creates a stimulating and motivating climate that plays a significant role in the learning process.

–Plus, adequate, zero, minus communication and anti-communication

There is ***plus communication*** in teaching when the recipient of the message has achieved a higher level of communication than the sender of the message. It provides the basis for creative work and is very valuable and important for the education process.

Adequate communication is characterized by "intensive and dynamic two-way exchange of information between teachers or some other source of knowledge, and students" (Mijanović, 2004, 244). It enables the highest possible quality of the communication process to be achieved through the exchange of information and timely feedback.

Zero communication is based on the exclusive use of the sense of hearing in teaching, which ultimately results in insufficient knowledge of the message sent to the student, both by the recipient and by the sender. The very name of this communication says that it has a very weak (no) effect on the education process.

Minus communication is characteristic of traditional school and is conditioned by unnaturally imposed and unacceptable one-way communication for the student. In it, students receive rare, superficial, subjective and mostly untimely information about their own achievement, but the teachers themselves also did not have a timely and reliable insight into the student's' achievement. In this communication, the lack of feedback on the achievement results in insufficient and superficial acceptance of the essence of the message sent to the students.

Acommunication (anti-communication) is a type of communication in which students have the opportunity to express their opinion and to argue against the sender of the message if they deem it necessary. This type of pedagogical communication was sharply prevented and suppressed in the

traditional school, often with verbal and corporal punishment, because it was completely unacceptable to oppose opinions and arguments to what was presented in the message.

–Direct communication and long-distance communication (telecommunication)

Direct communication is face-to-face communication between people in the same room. This type of communication is the predominant one in the school and is based on direct contact between the participants. It, therefore, provides opportunity for achieving two-way communication and quality interpersonal relationships among participants. Regardless of whether it has a verbal or non-verbal character, it has the epithet of intensive and quality pedagogical communication. Considering the benefits of direct communication, didactic theory and practice has started favouring it, but also combining it with other types of communication, depending on the conditions and circumstances that prevail.

Long-distance communication (telecommunication) is a form of communication between two or more people, who are not in the same room or place and cannot communicate directly face to face. In this type of communication, educational content is transmitted via the Internet application, letter, television, book, telephone, Internet, etc. The main disadvantage of this type of communication is the absence of an emotional component and two-way communication. Although this type of communication is of great importance in situations when direct contact between the participants in the educational process is disabled, didactic research shows that it often happens that people involved in this communication often feel alienated, lonely and insufficiently motivated.

–Violent and nonviolent communication

Violent communication is a type of communication characterized by shouting, invoking authority, threats, insults, and even coercion. This type of communication is aimed at achieving a goal at the expense of the conflicting party. Communication itself is perceived as a means of achieving victory over the party with which there is a conflict.

Unlike violent communication, *non-violent communication* is characterized by understanding, respect, indulgence, tolerance and cooperation in solving problems. The goal of non-violent communication training is to develop an awareness that conflict is not caused by people but by a problem. Non-violent communication is the foundation for the process of humanization of the teaching process, and this issue has recently received a lot of attention.

The non-violent model of communication has the alternative name "heart language", "giraffe language" or "compassionate communication". All these names say that it is communication that connects reason and sensitivity and that it is focused on understanding oneself and others. The four basic components of nonviolent communication are: perceptions, feelings, needs and demands. An important feature of nonviolent communication is the use of ME messages instead of YOU messages.

A frequent pedagogical situation can be presented through the model of violent and non-violent communication: The student constantly comes to class without the necessary equipment for geometry exercises.

As an example of non-violent communication in which the above characteristics are clearly depicted, we could cite the following:

Violent communication	Nonviolent communication
Your behaviour is irresponsible	When you don't bring your accessories to each and every lesson, you show irresponsibility
I feel like you don't like me	I feel surprised and worried
You make me angry!	We need to respect our agreement
Don't make this happen again!	I wish (it would mean a lot to me) that it doesn't happen again

Rosenberg mentions the main differences between non-violent communication ("giraffe model") and violent communication ("snake model") through five determinants:

1. "freedom of choice versus freedom of consequence,

2. self-discipline versus obedience,

3. respect for authority versus fear of what the authority may do,

4. environmental control versus child control,

5. protective against punitive use of force."

These determinants of nonviolent communication are very important for the teaching process. In order for classroom communication to have the characteristics of non-violent communication and thus represent a positive and stimulating context that encourages the efficiency of the entire teaching process, it is necessary for it to: (1) create such a climate that students engage in all activities for internal motivation and not for external control (2) students build their own system of control and self-control, and not to base their behaviour on the model of reward and punishment (3) students see the value and importance of knowledge and skills provided by their authority (4) be mindful of the alignment between the environment and the developmental needs of students (5) use the method of punishment only when it protects the student.

The principles of non-violent communication in higher education teaching form the foundations of a stimulating climate that has a motivating effect on students and encourages them to make additional efforts and engage in accomplishing learning objectives. For this reason, teachers need to develop non-violent communication skills and change YOU messages as often as possible with ME messages.

Efficient pedagogical communication in higher education

One of the important questions that a modern teacher should pose to him/herself within the self-evaluation of teaching work is if the communication in his/her teaching process is effective? In that sense, all those who engage in teaching must be well acquainted with the qualities of effective communication in order to put it into practice. Effective communication is that type of communication that is characterized by the established interpersonal relationship and the quality of communication topics.

Interpersonal relationship in an effective classroom communication is characterized by understanding, sense of satisfaction, refinement of the relationship, initiating action and mutual influence, support, empathy, etc.

These qualities of interpersonal relationship in effective classroom communication imply a minimal presence of conflicts and the ability of teachers to adequately resolve such situations. It is very important to emphasize that the interpersonal relationship of effective teaching communication is not only the relationship between teacher and student but also the relationship between students themselves.

Emotional experience in communication is one of the important preconditions for effective communication. Satisfaction refers precisely to what a person feels when communicating. The feeling of dissatisfaction adversely affects the effect of communication, and as desirable feelings that cause satisfaction in communication are: sympathy, love, pleasantness, affection, respect, esteem, etc. If there is no satisfaction in classroom communication, the efficiency of communication is called into question.

Another important precondition for good-quality interpersonal relationships in effective classroom communication is empathy. As a form of "projecting oneself into someone's position, by identifying with someone" (Bratanić, 2003, 110) and as sincere understanding and acceptance of a person as he is, empathy is the main premise of the effectiveness of classroom communication. According to these features, empathic communication is possible if communication is characterized by: (1) a smaller number of students, (2) knowledge of persons participating in it, (3) developed sensitivity to various forms of manifested behaviour of participants, (4) developed motivation to achieve mutual connection of participants in the communication process.

Content-wise, effective communication should be characterized by: (1) the sender's ability to convey the message, (2) the recipient's ability to receive and understand the message, (3) eliminate or minimize communication distractors and (4) efficient feedback.

In order for these features to be successfully achieved in higher education, it is important, above all, that teachers and other participants in the communication process use terms and expressions of accurate and precise meaning. In this sense, it is important to take into account the denotative and connotative meaning of terms and expressions because their inconsistency is one of the main reasons for misunderstanding during communication. Denotative meanings are descriptive meanings, common to most people in a certain cultural environment, while connotative meanings are personal meanings that are inherent to each individual. Thus, for example, the denotative meaning of the word achievement is that which can be found in a dictionary, encyclopaedia and which is accepted by the majority, while the connotative meaning refers to the interpretation of achievement that is different from individual to individual. The existence of a significant difference between the denotative and connotative meaning of a word is the most common obstacle to the effective realization of the content aspect of classroom communication, because the communication process is effective to the extent that the interpreter attributes the same meaning to signs as the one who uses them. That is why it is important for the teacher to be mindful of the alignment between these two types of communication, to constantly check them and, if necessary, align them.

If we look at the presented features of effective communication and interpret them from the aspect of direct practice, we can unequivocally conclude that the existing higher education communication is mainly focused on understanding the content, while less attention is paid to feelings,

relationship improvement and encourage action. The main reason lies in the fact that their realization is more complex and requires didactic and methodological and communicative competence of teachers. For that reason, courses in which students are provided with modern knowledge in the field of pedagogy, didactics and pedagogical communication should be part of modern curricula of teacher study programs.

Overcoming the existing issues, i.e., increasing the efficiency of pedagogical communication in higher education is possible through a different approach to the roles of teachers and students in the teaching process and communication in it. Changes in the roles of teachers and students in the teaching process must be, above all, oriented towards overcoming the existing shortcomings of classroom communication and improving educational work. Thus, the teacher should replace his teaching role as often as possible with the role of coordinator, helper, diagnostician, instructor of active teaching, creator of new interpersonal relationships, counsellor, partner, etc. This interpretation of the new role of teacher is completely focused on both content and interpersonal aspects of pedagogical communication, which creates preconditions for its improvement and more efficient organization. The new roles of teachers place before them a multitude of demands in the field of education and training. As the process of initial teacher education cannot cover all the stated roles of teachers, their permanent professional development is necessary. Involvement in the process of professional development, of course, should be an individual initiative of the teachers themselves, while the organization of education must be planned, organized and implemented at the social level and in accordance with the country's educational policy.

Characteristics of effective communication in higher education also include:

- Elimination of objective and subjective factors that reduce the quality of communication such as: lack of attention, ambiguous requirements; fear, prejudice about the conversation content or about the persons with whom one communicates, labelling, belittling, criticizing, attacking, imposing one's opinion or will, etc.

- Creating a stimulating environment which includes: mutual respect, equality, unconditional acceptance without criticism and trial, honesty and integrity, respect for one's own and others' needs.

- Activist approach in communication characterized by: encouraging opinions, creating choices, exchanging ideas and feelings, encouraging critical, analytical and creative thinking, etc.

- Encouraging active listening through a quality relationship with the interlocutor, respecting feedback on understanding the message wishing to be conveyed, giving encouraging instructions, encouraging questions, etc.

- Compliance of teaching communication with the principle of humanity and democracy and the principle of individualization.

- Respect for each individual student, his individual capacities, needs and interests.

- Focus on positive activities, results and student behaviour through praise and highlighting student work and engagement.

- Encouraging student initiative in the communication process.

- Ensuring reversibility in communication.

- Creating a positive emotional context that is characterized by straightforwardness, cordiality, honesty and trust in the relationship between teachers and students.

–Interaction in classroom communication

The essence of communication in higher education is interaction, which is also a prerequisite for its success and quality. It represents "the interaction between two or more people, or one person with an inanimate source, in a process whose purpose is to convey messages (information) and create conditions for optimal (self) realization of a person" (Bognar, 2002, 359). Interaction as a feature of classroom communication, in addition to providing its multidirectionality, mostly ensures the reciprocity of action of all participants in the teaching process.

Teaching is based on human relationships and interaction that are established between teachers and students (individually or in groups). Most of the interaction in education is realized through communication in teaching. Interaction implies an active relationship that takes place between two or more people with the aim of influencing each other's behaviour. It thus ensures the mutual interdependence of the relationship that is realized between its participants. Interaction implies the interaction of people who have certain views about each other and who mutually determine each other's behaviour. Since the change of behaviour is based on mutual attitudes, and relies on the adaptation of interaction participants, both due to immediate circumstances and characteristics of participants, interaction thus plays a significant role in organizing the teaching process.

Interaction as a process has the following characteristics: (1) reciprocity of perception and evaluation and their manifestations of affection, i.e., dislike; (2) cooperation and competence as the general content of the interaction; (3) the relationship between the participants in the interaction: dominance, submission, authoritarianism (democracy), tolerance (intolerance), pleasantness (cruelty), consent (conflict), friendship (hostility); (4) ways and psychological processes of mutual influence in interaction such as: corroboration, imitation, persuasion, conformance, submission, etc., (5) tools and processes in interaction such as: rewarding, punishing, use of authority; (6) the course of interaction or the sequence of activities in the process, the conditionality of one interactive action (behaviour) to others among the participants in the interaction.

These activities characterize the interaction in the classroom and to a large extent enable it to successfully achieve the set learning goals and objectives, which is a prerequisite for the efficient teaching. Interaction in teaching, as we see, creates a connection and mutual conditionality in terms of attitudes and behaviour, as well as in terms of exchange of information, attitudes and acquired knowledge, which all contributes to the quality of the entire teaching process.

Conversation is very important for interaction in the classroom. The conversation that takes place between the participants in the teaching process is a successful means of interaction. During conversations as interactions, the following didactic impulses are used: speech, facial expressions and objects, which expand the student's scope of thinking. Speech impulses are most desirable when the student's response is insufficient to encourage more effort and achieve a satisfactory result. Some of the most common speech impulses are, for example: *try to explain this to me a little more precisely, help him, explain it a little better, you are close...*

Impulses with facial expressions or gestures, with proper use, are a very effective means of conversation because they have a very positive effect and do not interfere with the work of the group. Just one gesture like: head movement, facial expression, teacher's smile, raised eyebrows, etc. can have a better and more significant effect than a bunch of spoken words. Impulses with objects are

characterized by the use of teaching aids and are very suitable for making the teaching process more interesting and bringing a certain subject closer to students. The application of didactic impulses greatly contributes to the quality of interaction in teaching. For this reason, different models of conversation are often used in teaching. A question-and-answer conversation (the teacher asks and the student answers) is not the best way to talk because the interaction reduced to two individuals is poor. A somewhat more desirable model of conversation in teaching is a model in which more students answer the teacher's question. This model also does not meet the criteria for a good-quality classroom conversation because, in addition to the interaction between teachers and a large number of students, it still lacks the interaction of students with each other. The most desirable model of classroom conversation in terms of achieving quality interaction is the model in which, based on the teacher's question (impulse), there is a conversation between students. The role of the teacher is to control that the conversation is not interrupted, i.e., to guide students during their conversation. By applying this model of classroom conversation, communication and interaction significantly gain in scope and quality, which directly affects the efficiency of the teaching process.

Given the quality of the interaction, we can talk about the following levels of interaction between communication participants:

(1) Physical presence (nonverbal communication, different levels of internal connection);

(2) Action-reaction communication (question-answer, no internal connection, information process - without influence);

(3) Empathic communication (empathy for others, adapting communication to those with whom we communicate, informing and influencing);

(4) Dialogue (mutual empathic communication, mutual influence - the ideal human communication)" (Bratanić, 1990: 98).

Although all four levels of interaction can be found in practice, it is important to emphasize that from the aspect of their quality, role and significance, empathic communication and dialogue should be strived for in the teaching process.

Active listening as the basis of effective communication

The precondition for effective communication in higher education is active listening. Although active listening relies on the sense of hearing, it cannot be reduced to the passive ability to receive sound or information, because it necessarily requires intense cognitive activity of the listener. This means that during the conversation we show a desire to listen to the interlocutor, look him in the eye, do not interrupt him listen with understanding, tolerate views or opinions that differ from ours, recognize feelings hidden behind sentences uttered by the speaker, and try to encourage the other person to express their needs, opinions, emotions (Galina, 2013).

Active listening has two stages: recognizing the basic information that is transmitted and using this information in a broader communicative context. As a communication skill, it presupposes from the interlocutor or listener to make a certain mental effort in order to try to understand different levels of messages, from verbal to those expressed by silence (Purić, 2016).

From the aspect of the teaching process, depending on the set goal and content of teaching work, active listening in higher education has an informative, critical, reflective and entertaining

character (Radojević, 2015) because it provides preconditions for effective understanding, memory, analysis and assessment, establishes relationships, creates a fun environment, etc.

When we talk about active listening as a prerequisite for effective pedagogical communication, Brilhart et al. list the following qualities of a good listener that are especially important in higher education:

a) A good listener pays attention to the context in which something is said,

b) A good listener pays attention to the feelings of the speaker,

c) A good listener asks questions to make everything clear to him,

d) Interprets silence and pause correctly and reacts accordingly in communication (Brilhart, Galanes, and Adams, 2001, p. 54)

According to individual characteristics in the process of listening, we can mention four dominant listening preferences:

1) People-oriented listeners - care about how their listening behaviour affects the behaviour of the presenter and other participants in the communication process. They demonstrate care and no criticism towards the presenter.

2) Action-oriented listeners - mostly focus on physical action: such as demonstration, drawing, preparation of materials, writing, etc.

3) Time-oriented listeners - take care of the schedule of activities and time for their implementation.

4) Content-oriented listeners - enjoy analysing things they have heard and are interested in sources from which they can learn more about the topic of communication.

In higher education, these listening preferences give the teacher the opportunity to activate students of different preferences, in accordance with the lesson content, goal and defined objectives, but also helps them to build and develop the characteristics of other preferences and put them in the service of active listening.

–Obstacles to active listening

Various obstacles to active listening can occur in the teaching process. Their frequency and character depend on the individual characteristics of students, the content of communication, but also the communication skills of teachers and students. The frequency of these barriers in higher education can be reduced to a minimum by proper planning and implementation of the teaching process, provided that the participants in the communication process have an enviable level of communication skills.

The most common obstacles to active listening in higher education are:

(1) *Pseudo-listening* which implies false attention and focus during communication which conceals the actual absence of attention in communication. It is most often manifested by some frequent gestures such as nodding, raising eyebrows, etc.;

(2) *Digression* implies focusing on certain digressions, i.e., running away from the main topic to secondary and less important issues and topics;

(3) *Focus on irrelevancies and distractors* is a phenomenon characterized by directing attention to the noises that accompany communication (noise, music, objects in the room, light, temperature, air, clothes and the appearance of the interlocutor);

(4) *Single-layer or surface listening*, which is characterized by the listener listening to only part of the information and directing attention memorization in order to leave the impression that he actively participated in the entire conversation;

(5) *Selective listening* - when the listener listens only to what he is particularly interested in, which may be of the greatest benefit for him, etc.;

(6) *Selective rejection* - when the listener focuses on topics that he does not want to hear and in the part of the conversation when they are talked about, he is "excluded" or withdrawn;

(7) *Interrupt or interject someone* - when the listener can hardly wait for the opportunity to say something and interrupts someone during a phase of the conversation not intended for interaction and two-way communication;

(8) *Listening in "ambush"* - it is characteristic of the listener that listens to the presenter in order to attack him whenever it seems to him that his words can be questioned;

(9) *Defensive listening* implies a constant desire of the listener to mentally, verbally or actively defend himself from everything that he perceives in communication as a certain type of attack;

(10) *Too quick to conclude* is a type of tactic that students use to shorten or interrupt the flow of pedagogical communication. By making conclusions too quickly, they often deliberately interrupt the speaker in order to show him that they understood and came to conclusions on a certain topic even before the end of the presentation.

If we look at the abovementioned risks or obstacles that accompany active listening in teaching, it is important to emphasize that teachers with their communicative and didactic-methodological competencies can successfully identify these phenomena and prevent them. In order to prevent the occurrence of these barriers and encourage active listening in higher education, numerous techniques can be successfully used to encourage active listening.

−Techniques to encourage active listening in higher education

(1) *Paraphrasing* - repeating what is said in one's own words. Using this technique, the teacher can very effectively check whether the student understands what was being said or whether he was an active listener and motivate him to continue with cognitive and emotional involvement;

(2) *Summarizing* - highlighting the main items, and pieces of information mentioned in the conversation or repeating the main topic and feelings that the speaker showed or expressed;

(3) *Asking questions* - ask a question to the student and put him in a position to continue speaking and presenting in order to obtain a complete answer that would prevent misunderstanding;

(4) *Clarification* - implies the skill of asking positive questions so as to motivate the student, encourage him to express or clarify his opinion, position or assessment and further clarify, explain them;

(5) *Rewording messages* - reword messages you have received from students to check that you have heard and understood it well;

(6) *Encouragement, uplifting* - encourage students to invest extra effort and commitment around the content of communication and their mental engagement to see the cause-and-effect relationships and relations, or to express a critical attitude about the problem of communication;

(7) *Facilitation* - a process of encouraging students to speak as often as possible by using verbal and non-verbal signs that let him know that we are listening carefully (eyes wide open, shrugging shoulders, ,, hm ..., yes ...., aha …);

(8) *Listening without condemnation* - show to students that we approach the conversation without prejudice and with an open attitude to listen to other people's opinion, regardless of whether it is contrary to our own;

(9) *Empathic communication* - show that you are capable to see things from the position of students, to understand their attitudes, opinions and feelings, that is, to put yourself in "their shoes";

(10) *Reflection* - give students your opinion about his actions, actions, feelings so that they know what effect their actions have left on you;

(11) *Confirmation or evaluation* - clearly confirm or evaluate the attitude or action of the student and thus show respect and appreciation in order to further motivate them to actively listen.

The use of techniques for encouraging active listening ensures the mental and emotional involvement of students in the process of communication, interaction and effective communication.

Constructive conflict resolution as a prerequisite of effective communication in the classroom

Conflict can be defined as interpersonal disagreement which is characterized by open or latent conflict between people with different interests and pronounced disagreements about the realization of certain goals, objectives or activities. Conflicts are a part of everyday life of all of us and require a dedicated approach in overcoming them because the behaviour of people in conflict situations depends on many factors such as the person we came into conflict with, the cause, course and content of the conflict.

Conflicts can be divided into: internal conflicts, interpersonal peer conflicts, teacher-student conflicts, family conflicts and conflicts with strangers. The teacher, as a key factor in teaching, must necessarily know the essential features of the conflict and the ways of reacting in order to successfully resolve situations in which conflicts arise in his / her educational work. The three basic models of conflict resolution are:

Win-win: solutions that provide each side with a certain benefit;

Win-lose: solutions in which one side has certain benefits at the expense of the other;

Lose-lose: solutions in which neither side profits.

Although conflict resolution according to the win-win model is the most difficult to achieve, the teacher with his social competencies should always strive for this goal. However, it is important to know that the other two models also have significant educational value in situations when students need to be drawn attention to the harmfulness of active participation in conflicts.

Successful realization of instruction requires the teacher to be well acquainted with the ways of reacting to conflicts and to make proper choices in line with the specific situation. The main styles of reacting in a conflict situation are:

Withdrawal is a passive way of reacting and implies mental avoidance of conflict and believing that the conflict will disappear on its own. Although withdrawal from conflict situations should be avoided because the conflict will certainly recur in the future, this response model is useful in cases where the conflict is not significant and when it ensures a task is finished.

Concession is adjustment to the other party and is characterized by concern for the interests and needs of the other party. Both sides tend to reduce the differences between them and emphasize similarities. An apparent harmony is created, but the essence of the problem is neglected.

Compromise is the willingness to give up something in exchange for something else and most often implies a quick mutual solution that partially satisfies both parties. In this model, an acceptable solution is sought, not an optimal one.

Cooperation is an open confrontation with the conflict and a focus on a mutual satisfactory solution. As the most effective way to resolve conflicts, cooperation is based on analyzing the differences between the conflicting parties, finding and resolving problems so that both parties benefit.

Ways of resolving conflicts that should be especially avoided in teaching are: competition/conflict and hedonistic accommodation.

Competition is the use of power to achieve one's goal and is characterized by an orientation towards personal interests and a complete neglect of other people. This is the least desirable way of resolving conflicts and should be avoided in teaching.

Hedonistic accommodation implies the tendency of the teacher to satisfy both sides in the conflict, even when the demands are unrealistic. This is the wrong approach and can deepen the conflict.

Teachers and all those who are directly or indirectly engaged in education process should focus on constructive conflict resolution. The basis of this approach is:

1) decentring – seeing things from other people's perspectives?;
2) isolate problems from the conflict;
3) side view - lateral approach to the problem;
4) clear expression of feelings; translation to needs;
5) formulate requirements or expectations;
6) seeking alternative ways to meet vulnerable needs for both parties in the conflict;
7) seeking and reaching consensus;

The skills that presuppose constructive conflict resolution that teachers must develop both during formal education and through professional development and continuous self-education are:

1) active and reflexive listening / listening with empathy;
2) translating the statements of both parties to the conflict into the language of needs and feelings;
3) translation of YOU - speech and ME - speech;
4) self-respect - essential needs;
5) respect for the other person – his/her essential needs;
6) focusing on the problem (technique here and now);
7) clearly expressing one's own feelings and needs regarding the problem;
8) respect for the other person and care for him/her in the conflict;
9) taking responsibility for one's own behaviour.

Thanks to the abovementioned skills and orientation towards constructive resolution of conflicts, teachers can ensure the minimum number of conflicts and successfully resolve them when they occur.

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Appendix 1: Scenario of a lesson topic: Active listening in the classroom

Lesson topic:	ACTIVE LISTENING IN THE CLASSROOM
Content overview:	- Characteristics of active listening; - Listening preferences; - Obstacles to active listening in teaching; - Techniques to encourage active listening.
Objectives	Understanding the qualities of active listening in the classroom; - Being acquainted with listening preferences and the possibility of their use in the teaching process; - Being trained to effectively identify obstacles to active listening in teaching and take measures to address them; - Adoption and practical training for the application of techniques for encouraging active listening.
Learning objectives	It is expected that after these lessons students will be able to: 1) understand the characteristics of active listening in teaching and build an active relationship towards them; 2) recognize listening preferences and possibilities of their efficient use in the teaching process; 3) identify obstacles to active listening in teaching and take adequate measures to eliminate them; 4) apply techniques of encouraging active listening in teaching practice.
Instruction methods	- Conversation (discussion), Demonstration, Oral presentation (description, explanation, speaking), Practical and illustrative papers.
Instruction type	- Group, Frontal and Individual
Teaching aids	- Colored paper, markers, box - Learning material: - Suzić, N. (2005). Pedagogija za XXI vijek [Pedagogy for the 21st century], Banja Luka : TT Centar, pp. 183 available at https://www.academia.edu/7077733/Nenad_Suzic_Pedagogija_za_21_vijek - Bognar, L. (1998). Govor nenasilja [Non-violent speech]. Osijek, pp.36. (Radni list "Znaš li slušati" [Worksheet "Can you listen"]) available at https://ladislav-bognar.net/sites/default/files/Govor%20nenasilja_0.pdf - Worksheets on techniques for encouraging active listening: http://treninzi.rs/tehnike-aktivnog-slusanja/ http://www.obukeikursevi.com/vestina-aktivnog-slusanja/ - Evaluation sheet (part of the lesson scenario)

MAIN LESSON: 8:30 – 10:00

INTRODUCTORY PART OF THE LESSON: 08:30-08:45

The introductory part of the lesson aims to motivate students to think about the characteristics of active listening in instruction.

Teacher: provides students with a prepared *Worksheet No. 5* which they fill in anonymously based on their experience.

Students: complete the Worksheet that contains questions about some elements of quality active listening such as: *Do you look at the person speaking? Do you listen and use facial expressions and gestures? Do you think about what the person is saying? Do you sympathize with that person? Do you ask questions if you don't understand something? Do you try to put yourself in that person's shoes? Do you occasionally reinterpret what the person is saying to make sure you understand well? Do you help a person clarify their problem? Do you support a person to solve their problem on their own?* In addition to these questions in the worksheet, students can add some other ways that can improve their listening skills.

After the students fill in the worksheet and put it in the box on the table, the teacher takes out the sheets and everyone together analyses how many students are looking at the person speaking, using facial expressions, etc. Based on the results, everyone evaluates the results together and concludes which elements of active listening in instruction can be improved. The teacher emphasizes that this is what will be learnt in today's lesson. The teacher defines what active listening is and states how it differs from ordinary, everyday listening.

In this part of the class, they **do not** analyse the open question from above - How can listening be improved.

MAIN PART OF THE LESSON: 08:45- 09:50

First part: 08:45 -09:15

Teacher: divides students into 9 groups. Each group receives learning material related to:
1) groups 1-4: one listening preference: Orientation to people, Orientation to content, Orientation to the flow of time, Action orientation;
2) groups 5-9: one of the obstacles to active listening: Pseudo-listening; Digression; Focus on irrelevancies and distractors; Defensive listening; Too quick to conclude.

Learning material which the groups use is actually excerpts on listening preferences and obstacles to active listening from: Suzić: Pedagogy for the 21st Century, p. 184,185, 186.

After distributing the materials, the teacher defines the time for group work (20 min) and shares the tasks that students should accomplish within the group work. The teacher tells the group members to divide these tasks on their own.

Student group work:
Tasks for students from groups 1-4:
1) analyse the properties of listening preference and summarize its basic features;
2) create an example of the stated preference from the position of a student;
3) show an example of the stated preference from the position of a teacher.

Tasks for students from groups 5-9:
1) present the essential features of obstacles to active listening;
2) create an example of the stated obstacle from the position of a student;
3) show an example of the stated obstacle from the position of a teacher.

After working on the tasks, the groups summarize the results and conclusions of their work (10min) by agreeing on how they will present this.

Second part: 09:15 - 9:45

Teacher: Explains that students have learned about the 4 listening preferences defined by Kitty Watson and the most common barriers to active listening in class, and opens a plenary presentation in which students will present the results of group work.

Plenary presentation of groups: (30 minutes)
Firstly, groups 1-4 present the characteristics of listening preferences and give examples from the position of students and teachers, followed by groups 5-9 who present the most common obstacles to active listening and examples from the position of teachers and students.
During the plenary presentation by the groups, the teacher coordinates and guides the students.

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FINAL PART OF THE CLASS (9.45-10.00)

</div>

Discussion on conclusions and highlighting their applicative value in immediate teaching practice.
The teacher talks about:
1) the importance of listening preferences in teaching and the possibility of their efficient use;
2) teachers' skills to recognize obstacles to active listening and improve their skills in this field.
Students actively participate in the discussion by sharing their experiences and dilemmas they may have after completing the assignments.

EXERCISES: 10:15-11:00

<div align="center">

INTRODUCTORY PART OF THE LESSON (10:15-10:20)

</div>

Teacher: tells students that there are numerous techniques to encourage active listening. He notes that their selection depends on the number of students, the nature of the content that is learned in class, but also the characteristics of each individual. He explains to the students that they will get acquainted with the main techniques and introduces them to the organizational issues of group work.

<div align="center">

MAIN PART OF THE CLASS: 10:20-10:50

</div>

Part One: 10:20-10:30

The teacher divides the students into 6 groups: Group 1-Paraphrasing, Group 2-Summarizing; Group 3-Ask a question; Group 4 - Facilitation; Group 5 - Encouragement; Group 6 - Explanation.
After forming the groups, the teacher gives the students worksheets on techniques used to encourage active listening:

> http://treninzi.rs/tehnike-aktivnog-slusanja/
> http://www.obukeikursevi.com/vestina-aktivnog-slusanja/

Student group work: students work on assignments in groups.

Assignments for students:
1) get acquainted with the technique of encouraging active listening (5 min)
2) based on their experience, describe an example of a given technique or create an example if students did not have experience with a given technique (5min)
After working on the assignments, students plan a plenary presentation of the results.

Part two: 10:30-10:50

Student activities: Plenary group presentation
All groups present their technique and describe an example.
Teacher-student activity
The teacher helps, explains, guides group presentations

FINAL PART OF THE LESSON (10:50-11:00)

The teacher takes out the *worksheets* that the students filled out at the beginning of the first lecture and gives the students the opportunity to write the answer with red pen to the following open question - How can listening be improved. Students use ☺ and ☹ to indicate where they are now compared to the beginning, i.e., how much they learned about this topic.

Evaluation: Students complete the evaluation scale by marking the level of achievement with an X sign. After the student have completed this, the teacher evaluates their engagement in class, understanding of the content, and the ability to apply the acquired knowledge (with a different colour of pencil with a grade 5-10).

Evaluation scale:

Student name and surname:	5	6	7	8	9	10
I know what active listening is						
I know listening preferences						
I am familiar with the obstacles of active listening						
I can recognize the most common obstacles to active listening						
I have mastered techniques to encourage active listening						
I am able to use techniques to encourage active listening						
TEACHER'S ASSESSMENT	engagement		understanding		application	

Appendix 2: Scenario of a lesson topic: Constructive conflict resolution in the classroom

Lesson topic:	**CONSTRUCTIVE CONFLICT RESOLUTION IN THE CLASSROOM**
Content overview:	- Conflicts, features, causes, types and solutions; - Conflict response styles; - Constructive resolution of conflicts in 6 phases; - Creating a model for constructive resolution of conflicts in the classroom.
Objectives	- Understanding the nature of conflict and potential models of response in conflict situations; - Being able to recognize conflict situations and choose optimal response models; - Mastering and managing the technique of constructive conflict resolution; - Training for constructive conflict resolution in the classroom.
Learning objectives	After the lessons, students will be able to: 1) Understand the nature of conflicts and develop models of reaction in conflict situations; 2) recognize conflict situations and use adequate conflict resolution models; 3) use the constructive problem-solving technique; 4) constructively resolve conflicts in the immediate educational practice.
Instruction methods	- Group, Individual and Frontal
Instruction type	- Practical work, Conversation (discussion), Demonstration, Oral presentation (description, explanation, speaking)

Teaching aids	- Flipchart, coloured paper, felt-tip pens, coloured papers
	- Learning material:
	- Suzić, N. (2005). Pedagogija za XXI vijek [Pedagogy for the 21st century), Banja Luka : TT Centar, pp. 310-360 available at https://www.academia.edu/7077733/Nenad_Suzic_Pedagogija_za_21_vijek
	- https://www.living-democracy.com/me/textbooks/volume-2/unit-4/
	- Pedagogical situations / Teacher's license available at http://licencazarad.palankaonline.info/pedagogija/10-pedagoske-situacije
	- Evaluation sheet (part of the lesson scenario)

MAIN LESSON: 8:30 – 10:00

INTRODUCTORY PART OF THE LESSON: 08:30-08:40

The introductory part of the lesson should lead students to think about conflicts and different ways of reacting to them.
Teacher: introduces students to the topic of the class with a heuristic conversation, i.e., by asking developmental questions: *Is conflict a term we encounter almost every day? What is conflict? How often do conflicts occur in class? What are the most common sources of conflict?*
After directing the students to think, the teacher suggests that there are three solutions to conflict resolution: win-lose, lose-lose, win-win, and asks the students to explain how they understand these.

MAIN PART OF THE LESSON: 08:40- 09:50

Part one: 08:40 -09:10

Teacher: divides students into groups using the four-corner technique. Each corner is called after one of the styles of reacting to conflicts (WITHDRAWAL, COOPERATION, RELAXATION, *CONCESSION*). Students join the corner that reflects their most common reaction style. If there are uneven group sizes, students choose a different reaction style according to the frequency and so on until numerically uniform groups are formed. Each group, in accordance with the reaction style, received worksheets (excerpts from the literature: *Creative conflict resolution in the classroom - materials*; *Suzić: Pedagogy for the 21st century*). After distributing the learning materials, the teacher defines the time for group work (30 min) and distributes the tasks that students exchange within the group according to their individual capacities and interests.

Student group work:

Assignments for students

1) analyse the characteristics of a particular conflict resolution style, critically thinking about them and synthesizing the conclusions from the point of view of instruction;
2) draw conclusions in which situations a specific reaction style can be applied in instruction and extracurricular activities;
3) think of a situation when the stated reaction style should not be applied in the classroom;
4) create examples of the correct application of a specific style in instruction or extracurricular activities.
All groups present their conflict resolution styles through the same (listed) tasks.

Part two: 09:10- 09:20

Student group work:
After having finished the assignments, the groups summarize the results and conclusions (10min) by agreeing on the way of presenting these. In order to make it easier to navigate in the plenary part that follows, students can present their conclusions on coloured papers or a mind map.

Part three: 09:20 - 9:45

Teacher: explains that the students were introduced to 4 styles of reacting to conflicts; that they differ in qualitative features and that they will be presented as such. Withdrawal and concession are seen as less desirable ones, while compromise and cooperation are the most desirable ones. Moreover, the teacher briefly describes the fifth, undesirable reaction style: conflict/competition. The teacher gives the floor to the groups that will present the results of assignments in plenary discussion.
Plenary presentation: (**20 minutes= 4*5 min**)
The groups present their response styles from the aspect of defined tasks.

The teacher coordinates their presentation, guides the students, emphasizes the most important things.

Part four: 09:45-09:50

Discussion on conclusions and emphasis on their applicative and functional value in immediate teaching practice (5 min)

FINAL PART OF THE LESSON: 9:50-10:00

Teacher with an interactive PowerPoint presentation explains the basis of constructive conflict resolution through two basic units:

1) What is the basis of constructive conflict resolution?:
- decentring – seeing things from other people's perspectives;
- isolate/extract problems from the conflict;
- side view - lateral approach to the problem;
- clear expression of feelings; translation to needs;
- formulate requirements or expectations;
- seeking alternative ways to meet vulnerable needs for both parties in the conflict;
- seeking and reaching consensus and celebration.

2) Skills that are requirements for constructive conflict resolution:
- active and reflexive listening / listening with empathy;
- translating the statements of both parties to the conflict into the language of needs and feelings;
- translation of YOU - speech and ME - speech;
- self-respect - essential needs;
- respect for the other person – his/her essential needs;
- focusing on the problem (technique here and now);
- clearly expressing one's own feelings and needs regarding the problem;
- respect for the other person and care for him/her in the conflict;
- taking responsibility for one's own behaviour.

EXERCISES: 10:15-11:00

INTRODUCTORY PART OF THE LESSON: 10:15-10:20

Teacher: tells students that the goal of the exercises is to master the technique of conflict resolution. Instructs them in the way they should work and distributes learning materials *(Student learning material package: "Conflict resolution in six phases"-* https://www.living-democracy.me/textbooks/volume-6/chapter-8/exercise-2

MAIN PART OF THE LESSON: 10:20-10:40

Part one: 10:20-10:40

Student group work: students in groups formed in lectures work on the assignments.

 Assignments for students:
 1) Getting acquainted with the phases of constructive conflict resolution (10 min)

2) resolving specific conflicts by applying the mastered model (selected pedagogical situations for taking a license for teachers) (10min)

Part two: 10:40-10:10:55

Plenary presentation of created models for constructive conflict resolution and discussion about designed solutions.

FINAL PART OF THE LESSON: 10:55-11:00

Evaluation: At the end of the lesson, the teacher puts an evaluation sheet for each group on the flipchart. Each student evaluates the achieved outcome in their field with a grade of 5-10 according to the given criteria.
After them, the teacher defines the grades for each student by rounding off the student's grade or correcting it with a felt-tip pen of another colour, and then defines the summative grade.

Evaluation sheet/scale:

GROUP A	St.1	St. 2	St. 3	St. 4	St. 5
Knowledge of the essential features of conflict					
Understanding conflict resolution styles					
Identifying situations in which different conflict resolution styles can be used effectively in teaching					
Mastering the constructive conflict resolution technique					
The ability to create a constructive solution to specific examples of conflict situations					
TEACHER'S SUMMATIVE ASSESSMENT					

*Evaluation sheet is created based on the number of students. It should be filled out publicly and it is desirable that students and teachers communicate while filling it out (offer explanation, talk about dilemmas).

Author:
Jelena Petrović

QUESTIONS:

How does the constructivist theory interpret the process of instruction and learning?

What are the most common instruction types and methods in constructivist learning theory?

What is the role of teachers and students in constructivist learning theory?

What are the specifics of assessment in constructivist learning theory?

Why is constructivism important for higher education?

Constructivist approach to teaching and learning in higher education

Theoretical assumptions and practical possibilities

Contents

Introduction

Constructivism is a relatively new approach to the process of cognition and learning. Although a long period of development of pedagogical thought preceded the establishment of constructivism in education as we know it today, it has become a firm part of educational policies only in the last few decades. Today, one can recognize the increasing trend of popularity and more frequent practical use, we can even consider it the leading theoretical approach in education, and it is also the foundation of many modern education systems (Amineh & Asl, 2015). We can thank the changes in modern society, science and technology that put the individual in new social roles in which he is expected to be more active, aware, critical, independent, adaptable, cooperative, etc. Education systems are expected to support the development of such individuals, and constructivism as an educational paradigm offers methods, techniques, and tools for doing so. University education is more than ever facing the challenge of proper educational activity and nurturing socio-emotional and intellectual skills of its students as well as for developing professional and scientific skills. For this reason constructivist theory becomes the basis for teaching and learning in universities.

Constructivism is attracting more and more attention in modern education for many reasons, but at the core of all of them is the common goal: to make the instruction more efficient in comparison to traditional ways of instruction. Traditional instruction recognized students' success through achievements, and did not focus on learning skills or the practical application of knowledge. This led to pure memorization and misunderstanding the essence of what is being learnt, as well as to rapid

forgetting and inability to link learning material with the real-life context. In modern education, the role of individual experiences in learning and teaching is increasingly emphasized, while respecting the context in which these experiences are acquired. Therefore, the goal of the new education paradigm is to replace passive learning and standardized assessment of knowledge with interactive, collaborative learning and individualized assessment (Milutinović, 2011; Vrkić Dimić, 2011).

Constructivism refutes the long-held idea that knowledge, as such, can be transferred from the "knower" to the learner, that it can simply be transported from one person to another. Constructivism, in contrast, essentially presents the idea that the learner actually has his own share of responsibility in the process, much greater than the responsibility of a simple passive listener. Constructivists believe that knowledge is not received, but constructed. New, constructivist-based pedagogy, develops innovative curricula and strategies, and the transfer of knowledge as such stays in the past (Milutinović, 2016). Such an approach to education is all the more significant in higher education.

The advantage of constructivism is in focusing on meaningful, cooperative and experience-based construction of knowledge, and its value for instruction is significant: the roles of both, those who teach and those who learn are transformed, the focus is on active thinking and participation of all of the participants of learning process and constant development of their skills. Such a change of the educational paradigm is a hard and long-lasting process that requires a change of consciousness, i.e., self-reflection and professional development of the teachers. However, it also brings benefits, the most significant of which is greater affirmation of the teaching profession.

Certain difficulties can certainly be linked to constructivist teaching, such as overemphasized relativism, i.e., too much focus on situational learning at the expense of the systematic learning. However, a well-run learning process by teachers will prevent this, which in turn requires a thorough development of the professional competencies needed for constructivist teaching. The goal is to achieve such learning that is simultaneously experienced as a personal experience, applicable in specific situations, and on the other hand, systemically and logically connected with cumulative human knowledge. One of the biggest challenges of constructivist teaching is to find a balance between the level of attention paid to individual engagement and to leading the whole group to construct the knowledge accordance with the specific field of science.

Constructivism is now present at all levels of education, yet the development of an education system entirely based on constructivism requires much more effort and change and requires the abandonment of many established methods to which we are accustomed. In this chapter, we will explain the main assumptions of constructivism and show why it is justified to base university learning and teaching on the postulates of this theoretical orientation. The most important questions that we will answer are: What changes in the content and methods of teaching need to be implemented, how do the roles of the main participants in the education process change and how does the attitude towards assessment change.

Constructivism as a philosophical, psychological and pedagogical concept

Constructivism and scientific knowledge

When we talk about the beginnings of the constructivist view of reality in general, the philosopher Giambattista Vico was among the first to point out that people constantly transform themselves and the world around them, and the culture to which an individual belongs inevitably shapes his view of the world and reality. This constructivist view of the world has, over time, taken shape in the influential and widespread paradigm of the postmodern, which has emerged as an alternative to positivist conceptions (Ćirić and Jovanović, 2018). Post-modernism and constructivism question the traditional understanding of knowledge and scientific research and are characterized by the understanding that individuals create or construct their own understanding or knowledge through the interaction between what they believe in and the ideas, events and activities they come in contact with. Reality is constructed in the minds of people, and cannot be considered an external and independent entity; it is understood that knowledge is a subjective category. On the other hand, the positivist approach to research avoids subjectivity, uses standardized measurement instruments, and insists on the neutrality of researchers. It implies that knowledge is objectively measurable.

Constructivists believe that the researcher is deeply immersed in the context of the situation he is researching, that he is motivated by his own needs and that research is a creative process during which he finds possibilities and ways to investigate a certain phenomenon. They accept a pluralistic view of reality and embrace the possibility of observing the problem from different perspectives, as well as reviewing the results obtained. Although, seemingly, this approach calls into question the objectivity of the obtained results, it opens opportunities for researchers' creativity, critical review, interdisciplinary cooperation, dialogue, cooperation of researchers who nurture different approaches. Finally, constructivists tend to connect science with the general public, and to question the applicability and usefulness of professional and scientific achievements. Constructivists are open to creative generalizations, reject rigid traditional views and do not see scientific knowledge as static and immutable. The popularity of constructivism in modern society is justified by its contribution to the development of interdisciplinary research and the strengthening of pluralistic and hermeneutic approaches.

For constructivists, the facts that are known about the world do not exist somewhere outside the individual, and it is not in the moment he meets them with knowledge, that he discovers them and accepts, learns, adopts them as such. Instead, the basic position of constructivists is that the individual builds facts and knowledge through his own activity. Therefore, knowledge is always "shaped" by the specifics of the individual who constructs it - culture, values, personal characteristics, etc. (Babić, 2007; Vrkić Dimić, 2011). Authors Ćirić and Jovanović (2018) point out that relativism in looking at reality can be linked to the constructivist paradigm - reality is relative in the eyes of constructivists, i.e., locally and specifically constructed in each specific cultural context. Also, epistemology, i.e., the nature of the relationship between the subject who learns and the reality that he learns about, is essentially subjective, and the ways of knowing are hermeneutic and always imply a guided but subjective discovery of reality.

Constructivism as the education paradigm

Constructivist ideas are not new, they appeared in scientific disciplines even before the emergence of the constructivist approach in social sciences. Many of the ideas that today form the backbone of constructivism were first shaped in philosophy, and later developed in psychology and pedagogy. Some of these ideas can be found in the works of pedagogues and theorists from the end of the 18th to the 20th century, but they were officially introduced into pedagogy by pragmatism and progressivism during the 1920s, only to be revived in the 1960s encouraged by cognitivist psychology. The names of Rousseau, Pestalozzi, Froebel, Freire, and most of all Dewey are important for the development of constructivism within pedagogical science, but thanks to their child-centered orientation, Maria Montessori, Alexander Neill, Ovide Decroly and other prominent European pedagogues are also mentioned. In the field of psychology, the forerunners of today's constructivism, and scientists who mostly affected its development and introduction into education are Jean Piaget, Leo Vygotsky and Jerome Bruner (Ciric and Jovanovic, 2018; Milutinovic, 2016; Kim, 2001; Potkonjak, 2000).

All of them, more or less, advocated the thesis of "constructed" knowledge which contains two assumptions: first, the learner constructs that new knowledge on the basis of his previous knowledge, in other words - previous knowledge is important because it affects new knowledge; and secondly - learning, i.e., the acquisition of knowledge is not passive - it is an active process in which we either change new and unknown information by giving it our own meaning and interpretation based on our previous knowledge, or new information changes us or our cognitive structures and raises them to higher levels. The learning environment, in both cases, should be conducive to experimentation and dialogue, with learning outcomes viewed through the context in which they originated (Adams, 2006).

More simply, constructivism is a theory of how people learn. It believes that people construct their own understanding of the world through their experience they experience of the world and through thinking about that experience. When we encounter something new, we have to align it with our previous knowledge and experience. Thus, new knowledge will either change our knowledge and beliefs about something, or it will be rejected as irrelevant. In both cases, we actively participate in the process: we ask questions, research and evaluate.

Applied to university surrounding, the constructivist approach to learning offers different ways of teaching, the common denominator of which is encouraging students to use active learning techniques (experiments, problem solving), to rethink the obtained results and solutions and to discuss the process and results. This process should be accompanied by self-evaluation and feedback containing the information which activities are the most efficient in understanding the content. By questioning themselves in this way, students in a constructivist classroom master learning technique, that is, "learn how to learn". Learning thus becomes a sustainable process.

Example:

The teacher initiates a discussion about a problem and assigns a group of students to solve it. She does not rush into offering the solution or navigating the students, but encourages them to present their ideas, to reformulate the questions or change the perspective. She gets the students to think about what they already know about it, and when someone comes up with a relevant idea, she "grabs" on it and suggests to the group that it might be a good direction for further research. In the end, they talk about what they

learned, how they came up with the conclusions, what was useful to them in their work, and what was not.

As we can see from the example above, contrary to the opinions of critics, constructivism does not reject the active participation of teachers, nor does it underestimate the value of expert knowledge. It only modifies that role, so that teachers help build knowledge instead of reproductive learning. They provide tools such as problem solving and research-based learning that help students formulate and test ideas, draw conclusions, and share their observations in a collaborative learning environment. Constructivism transforms the student from a passive recipient of knowledge into an active participant in the learning process. Guided by the teacher, they constantly actively construct new knowledge, and do not merely memorize it from the teacher or from the book.

Another objection to constructivism that it is a learning theory that needlessly wastes energy because it expects students to "reinvent the wheel". But, although the shorter way would be asking them to memorize facts and get the final solutions, in this case we waste the opportunity to develop inquiry spirit and self-confidence. In constructivist teaching, students are engaged in the application of knowledge and real experiences, they learn to set hypotheses, test theories and draw conclusions from the results obtained. They are not expected to reinvent a wheel, but to understand „how and why it turns and what it serves for".

In summary, constructivist pedagogy can be described through the following basic features:

1. student-oriented and respect for his origin and prior knowledge

2. providing support to students in building their own perspectives and opinions

3. prioritizing dialogue in the classroom, which allows for a climate open to exchange

4. learning goals and objectives chosen based on authentic problems and needs of students

5. developing awareness of the existence of different points of view and perspectives

6. providing them with opportunities to change and supplement existing attitudes, beliefs and understandings

7. developing awareness of one's own learning process (Milutinović, 2016: 13)

It is also important to highlight that constructivists believe that students construct knowledge in the same way in traditional instruction; the difference in constructivist teaching is that it creates optimal conditions for it and provides adequate support to the student.

Individual and social constructivism

Constructivism in education today is seen in two forms. Those are individual (cognitive) and social constructivism (Milutinović, 2016). In the following section of the paper, we will briefly explain both of these directions and their specifics. However, what they have in common is the main concept that knowledge is not acquired passively, as the traditional paradigms of education have pointed out, but that the subject who learns always actively participates in the construction of knowledge. The main difference between these two variants of educational constructivism is in the role that each of them assigns to the social context.

Individual constructivism starts from the internal, intrapsychological cognitive processes of the learner in the process of his learning and cognition; for that reason, some authors call it cognitive

constructivism. Piaget's theory of cognitive development can be considered the basis of individual constructivism. Piaget emphasized that learning does not take place passively, but takes place through an active construction of meaning. In particular, we give meaning to this new knowledge by connecting it with what we already know - we try to assimilate it into our already existing knowledge. In this process, new knowledge is what changes and tries to fit into our already existing system. In contrast, in situations where new knowledge exceeds our ability to modify and assimilate it, we are the ones who modify and adapt to new knowledge - now we restructure our existing knowledge to a higher level of thinking, and this is called the process of accommodation (Amineh & Asl, 2015).

> Example:
>
> If I think that friends are people who are always nice, and I meet a person who is always nice to me, I will start to consider that person a friend. Which means I assimilated the new knowledge into the previous one. However, one day I will meet a person who is different because sometimes he pressures me to do my best and I try harder, and he is not always nice to me. Then I will change my scheme (definition of friendship) and I will consider friends as people who do not always have to be nice, but always want the best for us. This change may make me reconsider whether the people I used to consider friends still fit into that picture.
>
> This change of perspective applies also to the scientific and professional knowledge, and the more students are flexible and the less teachers are authoritarian, it is easier to be achieved.

In a word, Piaget believes that knowledge is built on the basis of previous experiences of the individual, and that it is then improved in interaction with the social environment. The direction of the construction of knowledge is here from the inside out, from the individual and his intrapsychological processes to the external social environment. This implies that an individual can learn new information only on the basis of already existing structures, which implies that teaching should be adapted to individual levels of cognitive development (Milutinović, 2016).

Social constructivism, as opposed to individual, emphasizes interpersonal relationships in the process of learning and cognition. It focuses on interpsychological processes, that is, on the interaction between an individual and his environment in order to learn and develop (Adams, 2006; Kapur, 2018; Milutinović, 2011). Social constructivism is increasingly suppressing the individualized approach and today it is a much more common form of constructivism in education. It emphasizes the importance and efficiency of joint construction – co-construction of knowledge in the processes of social interaction.

The foundations of social constructivism are found in the teachings of another great development theorist - Leo Vygotsky. Studying language, opinion, and their interdependence, he came to the constructivist paradigm in which the process of cognition is socially conditioned, that is, it depends on the environment of the learner, as well as on the culture, language and context that prevail in specific conditions. More mental functions are actually internalized social relations. The direction of the construction of knowledge here is from the outside in.

Social constructivists also believe that reality is constructed through human activity, it does not even exist before people construct it in interaction with each other. As far as knowledge is concerned, it is also a product of human activity, and it is socially and culturally constructed. Individuals create their own meaning through their interactions with other people and with the environment in which they

live. Learning does not take place in isolation in the individual, nor does it imply the passive development of certain behaviors, but meaningful learning occurs when the individual is engaged in social activities. They also introduce the notion of intersubjectivity (Kim, 2001), which implies a common notion of reality among individuals whose interaction is based on common interests and beliefs, which forms the basis for their communication.

Social constructivism in education focuses on the role of social processes and cultural context in knowledge creation and learning. The way in which an individual perceives and interprets reality and his own experience in life - depends to a large extent on the social community and culture to which he belongs. The construction of knowledge is a product of social interaction, interpretation and understanding (Babić, 2007). Moreover, social constructivists believe that individuals, through interaction and use of language, share meanings and understandings of reality and thus build common knowledge, which can only then become internalized as an individual property. For that reason, the ultimate criterion for assessing knowledge, instead of objective tests, in social constructivism is considered to be consensus between several different learning subjects, that is, individuals. In other words, only those constructions around which the largest number of people from a given social group agree will be called truth or reality (Adams, 2006).

In university teaching, it is desirable to combine both types of constructivist learning. Scientific work requires deep reflection and dedicated individual work, and therefore it is necessary to give students the freedom of independent research. Using appropriate information, literature, available sources, examples, students can research, solve problems and come to significant conclusions. On the other hand, higher education is increasingly focused on the practical application of knowledge, and students must place their conclusions in the context of the state of modern society, science and the profession for which they are educated. That is why it is recommended to organize evaluation of students' work through analyzes, discussions and presentations in joint work of the whole group.`

Instruction types and methods in constructivist learning theory

The mentioned theoretical views of constructivism have also found application in classrooms and influenced the shaping of instruction at all levels of education. The following table summarizes the differences between traditional and constructivist classrooms, and below, they will be explained and illustrated. These features mainly describe pre-university education, but can also be present in university teaching. It is natural that teaching at the university is more open and closer to the constructivist paradigm, but there is space for further development and a more conscious and more systematic application of this approach to university instruction.

Traditional Classroom	Constructivist Classroom
Curriculum begins with the parts of the whole. Emphasizes basic skills.	Curriculum emphasizes big concepts, beginning with the whole and expanding to include the parts.
Strict adherence to fixed curriculum is highly valued.	Pursuit of student questions and interests is valued.
Materials are primarily textbooks and workbooks.	Materials include primary sources of material and manipulative materials.
Learning is based on repetition.	Learning is interactive, building on what the student already knows.
Teachers disseminate information to students; students are recipients of knowledge.	Teachers have a dialogue with students, helping students construct their own knowledge.
Teacher's role is directive, rooted in authority.	Teacher's role is interactive, rooted in negotiation.
Assessment is through testing, correct answers.	Assessment includes student works, observations, and points of view, as well as tests. Process is as important as product.
Knowledge is seen as inert.	Knowledge is seen as dynamic, ever changing with our experiences.
Students work primarily alone.	Students work primarily in groups.

Instruction types and methods based on social constructivism emphasize the need for collaborative learning. Socio-constructivist approaches to teaching include mutual teaching, peer collaboration, problem-based teaching, and many other methods that involve learning with others. From the point of view of social constructivism, learning is effective when students are divided into groups, groups are given a problem to be addressed, and group members approach solving problems from their own perspectives that are different from each other, given that everyone comes with different attitudes and knowledge. In this way, members of the group help each other to solve the problem more efficiently and completely than if everyone worked alone, individually (Kim, 2001).

Other effective teacher-related activities in a constructivist classroom would be: providing enough time for students to interact and exchange ideas; researching the way students think in order to understand their way of thinking which would further serve as a basis for organizing future lessons; encouraging students to engage in dialogue and exchange of ideas, and to contribute to the common construction of knowledge; asking open-ended questions and insisting on explanations from students; promoting and supporting inventiveness and divergence in students' thinking, as well as encouraging students to work in teams as often as possible, etc. (Kapur, 2018; Milutinović, 2011: 187). In addition to these, other methods of cooperative learning are proposed as alternatives to traditional methods: the reciprocal teaching method, cognitive apprenticeship method, legitimate peripheral participation

method, learning communities, etc. What all these innovative methods have in common is that they are based on the idea of developing situational cognition, which implies the development of authentic learning and thinking in a significant environment - in the specific context (Milutinović, 2016; Milutinović, 2011).

We will list and explain some of the instruction types and methods that are used to apply constructivist ideas in the teaching process. Those are:

Individual learning. A theory that insists on student activity will, naturally, rely on individual work. Independent individual work is done under the supervision of the teacher, but puts the student in the role of researcher. He uses his previous knowledge and abilities to create something new and thus improve his knowledge and abilities. Individual work also has a positive effect on the attitude towards work and the development of skills and abilities such as time planning, organizing activities, patience, concentration and quality control (Čolović, 2016). By applying the individual form of learning, constructivist ideas can be taken into account, such as: achieving an active position of students and respecting the individual characteristics of students and their experience.

Collaborative learning is a form of learning that uses joint problem solving, students explore agreed topics and create new ideas, combinations or unique innovations (Šefer, 2012). Working together in pairs and working in groups belong to social forms of learning. The reasons for the application of this form of learning are numerous: enabling the acquisition of collaborative competencies, coming to better solutions, satisfying students' needs and desires for social contact, choosing content according to interest and way of learning, closer cooperation between students and teachers (Matijevic and Bognar, 2005).

Team learning is one of the forms of collaborative learning. Team learning involves teams of two or more teachers and several student groups of different sizes working on a common problem. It implies flexible lesson planning and instruction, different sizes of space and time for the realization of the planned content and the use of a wide array of modern teaching aids. Students are worked with in large, medium and small groups, depending on the nature of the teaching material and the set tasks (Vilotijević and Vilotijević, 2016).

Instruction methods often used in constructivist learning are as follows:

Project based learning. As part of working on the project, students should be given tasks related to the current problem, in order to work together to determine the project goal, or a plan for solving this problem. Based on the collected information, they set hypotheses and draw conclusions, and the final phase of the project should be the practical application of the obtained results (Vilotijević and Vilotijević, 2016). Project based learning enables the selection of learning materials in accordance with the interests of students. By working on the project, students will learn how to research a certain type of problem, learn how to search for literature and other sources, to separate the important from the irrelevant, to use information, methods and theories correctly and critically. They will also acquire social skills, respect diversity and other people's opinions, acquire practical skills (modeling, use of tools or devices) and acquire entrepreneurial skills.

Problem-based learning. Solving the problem itself is preceded by a whole series of activities, and among them the most important is the observation that the situation is really problematic and the

search for a creative formulation of its solution (Krsnik, 2003). The student is faced with the task of discovering new, hitherto unknown knowledge and ways of acting. Mental strain is accompanied by emotional and nervous tension, and the way out of that situation is problem solving (Vilotijević and Vilotijević, 2016).

Authentic learning method (example demonstration, simulation environment). This type of instruction refers to the process in which learning material is presented to students in real-life conditions, reconstruction or simulation. With this method, it is good to reflect the complexity of the actual conditions and avoid simplification. (Matijević and Bognar, 2005). So it could be concluded that this type of instruction is to introduce students to phenomena and processes in their real form

Cooperative learning. In the broadest sense, it can be defined as any classroom learning situation in which students of different knowledge levels work in structured groups to achieve a common goal. In these groups, they agree, initiate, plan and evaluate each other. Instead of working individually and competing with each other, students are given the responsibility of building a community in which all students participate (Jukić, 2014). In cooperative learning, the interdependence of group members is much greater than in ordinary group work in which tasks can be divided and work is partially independent.

Inquiry based learning. In inquiry-based learning, student should use classroom theoretical and practical activities to discover and understand what is important in the content he wants to master. Teacher's task is to prepare materials that students will observe, analyze, see the relationships within it, highlight what is important and come to a conclusion (Vilotijević, Vilotijević, 2016)

As we can see, the choice of teaching methods is such that they are used to create situations and enable students to experience things during which they will construct knowledge themselves. Within constructivist instruction, direct transfer of knowledge is avoided, but the great attention is paid to the previous knowledge of students because it is the starting point for further learning.

The schedule of activities in the classes should be roughly arranged as follows:

1. Starting activities should help teachers determine the level of prior knowledge. These are short warm-up activities that help to evoke knowledge about a certain problem, short initial tests, informal conversations and the like.

2. It is very important that the learning situations students are introduced to are challenging for them. Those situations should open the way to new knowledge or encourage re-examination of old concepts, i.e., to create the so-called cognitive dissonance. Students will be more active and motivated if the contents are new, interesting and applicable in professional life. This can be achieved by assigning problem situations or research tasks.

3. Main learning activity. Here, it is important to allow enough time students to deal with the given problem. This part of the class can be realised through performing an experiment, proving a theoreme, opposing opinions, analyzing the literature, etc. Here, different forms and variants of individual and group work can be applied.

4. When conclusions and new findings are reached, feedback is very important. Students should be given the opportunity to evaluate and compare or practically apply the knowledge they have gained. This can be achieved through short presentations or reports, group discussions and quizzes, or through the creation of tutorials, instructions for future generations, or practical demonstrations.

5. Finally, it is necessary to evaluate the entire learning process. Students should become aware of which methods and procedures have helped them in the learning process, what were the disruptive factors and which learning techniques they could rely on in the future.

The possibility of organizing mathematics lessons based on the theory of social constructivism were explored in a school in Australia. Teachers were supported to create a learning environment in their classrooms that is in line with this philosophy. Instead of simple instruction, teachers used "math games", which were believed to be much more effective methods in terms of student achievement, information retention, increased motivation, and greater student engagement. It turned out that teachers in the process of implementing this project were in a double position: they organized classes for their students with the help of completely new methods, and at the same time they were in the position of the learner, organizing a social-constructivist exchange environment with their colleagues in order to gain new experiences and collaboration, in order to more easily master the new way of instruction. It turned out that, after certain initial difficulties, the implementation of social-constructivist postulates both in the classroom and in the cooperation between the teachers themselves was very successful. Teachers created a cooperative environment in which they could express their impressions, thoughts and experiences about the new way of instruction, exchange advice and learn from each other, and this is exactly the atmosphere they tried to create with their students in the classroom (Irvin, 2008).

The relationship between students and university teachers in constructivist-shaped university instruction

Roles and position of teachers and students

An important concept for constructivist instruction is the concept of "scaffolding". It refers to the fact that the teacher, as well as other students - peers, have the role of a scaffold that serves as a support for students in the process of building knowledge and meaning, until a particular student manages to independently control their own learning process (Milutinović, 2016; Milutinović , 2011). In this sense, the teacher should: provide an environment that encourages group interaction; to discourage competitiveness and encourage cooperation and exchange of experiences, to respect the opinions and contributions of students, without assessing them as true or false; to provide the necessary resources and materials; to create a climate in which students will feel free and safe to ask and participate; to be supportive of their colleagues, at a time when and at the level required (Idaresit Akpan et al., 2020: 54).

The role of the teacher includes guiding, providing proper direction, informing and encouraging students to think and discuss, to engage. In the beginning, his role is dominant, but as the learning process proceeds and students invest in working on the problem, so the understanding that the student has the greatest responsibility for his own learning process begins to prevail (Milutinović, 2011; Vrkić Dimić, 2011). Students, therefore, are required to be active participants in the co-construction of knowledge in cooperation with their peers and teachers, and to manage their own learning. Teachers have a more important role at the beginning - to create teaching situations for cooperative learning, and later their responsibility is transformed and they are there to monitor, structure, encourage and "ignite" learning that is already largely independent among students (Bay et al., 2012). The teacher should act as a guide for students to find their own learning objectives, he is not in the center of the class but learns together with the students, leaving them enough space for self-realization.

The nature of constructivist learning requires teachers to accept that each student constructs knowledge in a different way, and that these differences stem from differences in the ways individuals collect, select, interpret, and organize information they encounter in their life (Adams, 2006). Teachers introduce different ideas about reality into instruction, and provide students with support and guidance in acquiring and placing new knowledge in their own world of meaning. They also actively adapt teaching to students, while learning themselves (Murphy, 1997). Such a relationship is actually a process whose elements are improved, students learn how to learn more successfully, while teachers, based on specific situations, learn how to teach more successfully.

Therefore, social constructivism does not imply diminishing the importance of the teacher's role in the learning process. Moreover, the teacher has a more demanding role here than in traditional instruction, in terms of organizational skills, leadership skills, creativity, skills of active discussion and dialogue, etc. Instead of a mere lecture, the teacher now mediates and structures peer interaction among students, then clarifies students' doubts, directs students' activities and leads one large group interaction down the path of "aha-experience" to new discoveries. He is an organizer, moderator and collaborator, he must know the contents, teaching aids, materials and methods, as well as understand the possibilities of his students. He must ensure that the research problems are important for students and are not related only to the needs and interests of teachers and the education system.

University teachers are expected to:

1. Introduce different ideas about reality into the instruction process, to encourage, support and guide students in the acquisition and placement of new knowledge in their own world of meaning;

2. actively model and adapt instruction to students, while learning themselves;

3. encourage and accept student independence and initiative;

4. use a wide range of learning materials and motivate students to use them;

5. understand students' understanding of concepts before explaining their own understanding of those concepts;

6. encourage students to engage in dialogue with the teacher and with each other;

7. encourage students to ask open-ended questions that do not require an unambiguous answer;

8. ask students questions and encourage them to ask questions to each other;

9. seek reflection on students' initial answers;

10. encourage conversation, discussion and dialogue among the group members;

11. enable students to understand through the application of tasks;

12. expand learning outside the lesson, classroom and the school itself.

Constructivism also puts new demands on students and changes their traditional role. The student should be able to organize their own learning activity, evaluate their work and seek advice, information and support when needed. He should also be able to upgrade, acquire, process and assimilate new knowledge and skills. This requires effective management of one's own learning patterns, and especially the ability to persevere in learning, to communicate over long periods of time, and to critically reflect on the purposes and goals of learning (Mirkov, 2011). Constructivist theory requires that we change the need to describe reality and instead turn to students so that each of them creates their own model of explaining reality.

In university teaching that is naturally oriented towards research, critical re-examination of facts and creative reshaping of knowledge, the teacher and the student are already taking on the mentioned roles. What is needed for their consistent and continuous sustainability of these roles are adequate organization of space and time, support of modern technology and availability of adequate learning contents. Also, both teachers and students should be trained to use learning platforms, educative softwares, time management skills, communicative skills and other non-subject based competences.

Assessment in constructivist-oriented teaching

When it comes to assessment, constructivism has contributed to seeing academic success and failure differently. Before negatively assessing the student, the teacher will think about why the student answered incorrectly and what is the obstacle to understanding the content in the right way. When we talk about the evaluation of students' knowledge and progress in the instruction process, social constructivism requires the evaluation to be dynamic in nature - that learning is evaluated by authentic monitoring of the student's progress in social, collaborative activities. Students' progress will be positively assessed the more they engage in the activities in the social group within which they work. This includes certain qualitative techniques such as taking notes, collecting student portfolios, using non-standardized tests, etc. (Milutinović, 2011).

The constructivist approach to evaluation and assessment is, therefore, formative, not summative. Its intention is to improve the quality of learning, not to assess the level and quality of information learned. Therefore, evaluation should respond to the specific needs of teachers, students and scientific content. It depends on the context - what is effective in one class is not in another. It is also a continuous process. Teachers receive feedback from students, and then close the circle by giving students information about their achievement and opportunities to improve the learning process. It should not be used as a means to make some students happy with themselves and discourage others from ceasing to deal with certain problems. We can single out three evaluation processes that take place continuously in a constructivist school environment. These are self-assessment, peer assessment and collaborative assessment.

Self-assessment

By self-assessment or self-evaluation we sometimes imply a process in which students simply check their answers according to a predetermined assessment key and evaluate their knowledge on the test, but it is much more than that. Much more important are other aspects of the process, and these are the processes during which students monitor and evaluate their own thinking and behavior during learning and identify strategies that would help them improve learning. Self-evaluation has an effect when students evaluate their work and notice discrepancies between the achieved and the desired result. This aspect of self-improvement can be achieved in outcome-oriented education, which clearly defines learning goals and objectives and points to learning and teaching strategies that can contribute to improving outcomes. In essence, this means that students should first identify their learning strategies and the outcomes they have achieved, then evaluate them based on clearly defined standards and criteria, then decide what steps they will take to improve them, and finally continue to follow the process

with new strategies in place. This establishes a cyclical and self-sustaining system that leads to constant progress.

Self-assessment is extremely important because it is an integral part of the learning process. It relies on man's natural tendency to keep track of how far he has progressed in a particular activity. In addition, learning is possible only if the student has understood what else he needs to learn. In the end, it is important for motivation because it gives the student a sense of control and is important for understanding their own learning process, awareness of their strengths and weaknesses and opportunities to improve them.

Peer assessment

Peer assessment has several variants, but in essence it means getting feedback about your work from peers. This is a process to which we have been constantly exposed since we were little, because those who are engaged in the same activity are naturally interested in our work. They understand best the problems we face and the opportunities we have. Some authors (Falchikov, 2007) believe that this process is not recognized because it is suppressed in the traditional classroom due to the central role of the teacher, where evaluation is one of his main activities. However, it brings multiple benefits: it encourages collaborative learning and gathers students around a particular problem by asking them to assess what has been good for them. It increases the level of concentration in the classroom and leads to discussion. Finally, students who evaluate the work of others practice judgment, drawing conclusions, and making many intellectual and social choices.

Collaborative evaluation

Collaborative assessment/evaluation is a process closely related to the problem-solving process. One of its biggest advantages is that all people who work on solving problems are invited to participate, so that the focus is on the problem, and not on the people. This frees individuals from responsibility and prevents blame from being shifted from one person to another, which is a very harmful practice, and yet certain shortcomings, misjudgments or actions can be pointed out and a better solution sought. Another significant positive aspect of this type of evaluation is that new solutions are reached by those who are already involved in the process and interested in a favorable outcome. This is in contrast to the situation where experts who simply observe the process give suggestions in a much more natural and acceptable way. Collaborative evaluation strives for useful and practical goals, rather than assessments, diagnoses, and classifications of participants.

The most common assessment tools in constructivist teaching

Since the constructivist approach takes into account students' prior knowledge, focuses on their problem-solving skills and seeks to develop the potential for collaborative learning, it cannot rely on standard methods of evaluating student achievement. Traditional tests would not show what should skills should be developed, and therefore assessed. To evaluate the outcomes of constructivist learning method, it is necessary to use a much wider range of evaluation techniques and instruments, such as open problem solving, analysis, critical assessment, application of knowledge in problem situations, oral and written expression. Also, the constructivist paradigm requires that student academic success and their contribution to group success be evaluated (Sheppard, 2000). For that reason, evaluation and

assessment is a very complex and demanding task. In the following section, we will list some of the evaluation models and tools that are used.

Portfolio is a collection of student papers collected during one or more semesters that track the development of knowledge and understanding of certain problems within a scientific discipline, but also tracks the development of writing and speaking skills, terminology mastered, structured and systematic presentation skills, use of scientific literature and research techniques, etc. Portfolio is one of the most proper ways to track achievement in constructivist instruction for several reasons: it helps students themselves to see their own progress and gain insight into what they have managed and what they have failed to achieve. It provides the teacher with an insight into the speed of progress and the overall knowledge of students, and during the instruction it highlights student weaknesses, bad habits, etc. which can be corrected. Thus, the learning outcomes and the learning process are evaluated through the portfolio. The portfolio also provides individualized access to content and the opportunity for critical and creative expression of students. It is also important that this method of evaluation is not aggressive and does not cause stress, so the effects of anxiety are neutralized. However, since it is a free form, it is necessary for the portfolio to determine the criteria by which it will be evaluated and the elements it must contain. These criteria must be clearly defined and presented to students. Finally, the portfolio can be a starting point for discussions which will further contribute to its formative role.

Assessment tables are sets of criteria for student evaluation that are most often given in tabular form. They facilitate and speed up this process, and at the same time they are clear and enable quick feedback. Task descriptions and criteria and expectations are entered in the empty table. They represent a descriptive form of evaluation and are in line with the outcome-oriented approach. The most common elements of these evaluation tables are: Evaluation criteria, quality definition and scoring strategy.

These evaluation procedures and techniques often need to be combined with much more traditional techniques such as tests. In general, even constructivist teachers need more objective assessment methods, but they also use these methods because they create a balance in their evaluation processes.

Use of modern technology and constructivistic instruction

In the constructivist classroom, the use of modern technology is considered very important. Technology supports the construction of knowledge in many ways and facilitates the organization of the learning process. We have already emphasized that the teacher has a great responsibility in organizing the instruction process and that he must create an environment that will activate students' prior knowledge, help them discover new information and give them meaning, and finally enable adequate evaluation of learning objectives and processes. At each of these steps, modern technology is the most important support to teachers (Isik, 2018). And not just teachers, it is a significant support to students and provides them with a much higher level of freedom of independence and activity and thus supports the whole learning process.

For example, in activating previous knowledge, the teacher can use a short video clip, a series of pictures or a movie. This will remind students of previous experiences or knowledge, and if students do not have them, it will provide them with a basis for future learning. In addition to the obvious advantages such as fast access to information and individualization of the pace of learning that

technology allows, its importance for evaluation should be highlighted as well because it ensures very fast and accurate feedback, first to the student and then to the teacher. Furthermore, we must emphasize its role in the formation and development of higher mental functions and higher-order cognitive skills such as critical and creative thinking.

Finally, the great advantage of technology is in facilitating communication and collaborative learning. Whether it is via email, online meetings, discussion forums, online collaborative whiteboards, etc., the possibilities of communication, information-sharing and collaboration are simply inexhaustible. The use of modern technology supports the most important aspect of constructivist teaching, that is, independent activity and independent construction of knowledge. It, above all, motivates students to work independently, and then to share their experience.

Conclusion: constructivism and modern university instruction

In a society of rapid technology development, social change, and the expansion of information flow, it is essential that students develop skills that will provide them with lifelong learning, cognitive flexibility, and a willingness to be engaged and creative. This means that they are expected not only to know and understand existing concepts and practical abilities, but to search for new knowledge, overcome acquired routines, rethink concepts and ideas they know, and adapt to changing circumstances.

Constructivist pedagogy is necessary and possible in higher education. Students already have certain skills, have certain knowledge and it is assumed that they have developed responsibility for their own learning and independence in learning. This basis needs to be upgraded. University students, as adults and mature students, should be engaged in the active construction of knowledge, cooperative learning and need to be put in real-life situations from which they will gain experience and learn. This constructivist approach is often called holistic approach (Al-Huneidi & Schreurs, 2012) because it is integrated into the daily personal and professional life of students, with the goal of developing into a self-sustaining system.

However, university instruction is still predominantly traditional and is based on lectures and knowledge transfer. In order to overcome this problem, it is necessary to introduce as many elements of constructivist-oriented instruction as possible and strive to spread that model in university classrooms. The use of modern technology will facilitate this process and pave the way for many forms of instruction that can be permanently maintained in teaching practice, such as cooperative learning, blended learning and problem-based learning. Finally, let us recall the benefits of the constructivist approach and why it is desirable at the university level:

1. Develops thinking skills;
2. Encourages students to consider different possibilities and perspectives in solving problems;
3. Develops flexibility in thinking;
4. Engages students' prior knowledge so that they constantly integrate old and new knowledge. Due to the fact that groups of students are not homogeneous in terms of cultural and social context from which they come, opportunities open up for access to many resources and different perspectives;

5. Students can link the learning material with their real-life situations and experiences;

6. Students learn to support knowledge with evidence, reconsider ideas and oppose alternative views;

7. Students engage mentally, in order to understand and systematize their ideas about the world;

8. Students experience insights that go beyond ordinary learning and recognize the implications for practical use of knowledge;

9. Communication and social skills are developed;

10. Students learn to articulate their ideas clearly, to participate in the exchange of ideas and to cooperate with others in reaching final conclusions. This is a skill that is essential for success in a real life environment;

11. Alternative evaluation methods are encouraged;

12. Evaluation through grade books, reports, modeling, art creations, allows students to express their knowledge in different ways. This helps them retain this knowledge and makes it easier to transfer it to real-life situations,

13. Internal motivation for learning is encouraged;

14. Students' authentic view of the world is appreciated. It builds their self-confidence;

15. The advantages of modern technology are used.

Given all of the above, including these benefits of constructivist instruction, university teachers should be motivated to use this approach in their classrooms. The transition to constructivism can be done gradually, by connecting the traditional with the constructivist paradigm by combining problem-based learning and research that focuses on gaining thorough insight and the conceptual system of subjects (Mirkov, 2011). In some phases of the learning process, traditional methods can be used (introductory phases, recapitulation of what has been learned), while in other phases, research and discovery methods can be applied. Some important section of the learning material (key concepts and connections) can be studied more thoroughly, through research and problem solving. One part of the material can be researched, and the other can learnt informatively through discussions between the research teams of students.

In the field of higher education, constructivist pedagogy is therefore both necessary and possible. Students have already mastered certain skills, possess certain knowledge and it is assumed that they have developed responsibility for their own learning and independence in learning. This basis needs to be upgraded. Students, as adults and mature learners, should be engaged in the active construction of knowledge, cooperative learning and put in real situations from which they will gain experience and learn. The constructivist approach is often called holistic (Al-Huneidi & Schreurs, 2012) because it integrates into the daily personal and professional life of students, with the goal of developing into a self-sustaining system. This makes the use of a constructivist educational paradigm even more justified.
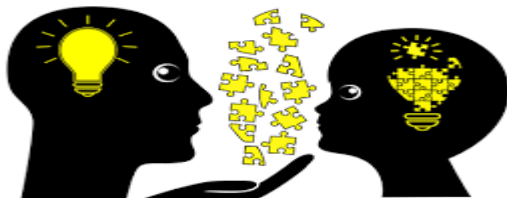
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Effective teaching through the believes and reflexivity of teacher

Contents

Introduction

The issue of effective teaching, in part, contains the possibility of resolving dilemmas about improving the quality of teaching and professional competencies of lecturers. Teaching is often classified as craft, but the descriptions also include the term art of teaching. It can be said that teaching is both, as well as that it includes the knowledge of the lecturer, the skill of presenting and disseminating the material, with the connotation and focus on the active role of the listeners and the use of active teaching strategies.

No matter how long you have been in the position of lecturer, whether you are a beginner or a teacher with significant work experience, the inevitable question you ask yourself is: How much have my lectures attracted the attention of listeners, or sometimes why are they not? Such re-examinations of lecturers, included in pedagogical science in terms of reflexivity, reflexive practice and reflective practitioner, are the paths of the development of teaching in the right direction. Namely, everyone who reflects (reflects, analyzes, thinks, connects and synthesizes) their own teaching work, opens everyday questions about good teaching practices, while the answers to the personal reflections of the lecturers become opportunities to improve their own and students' development. In any case, teaching "gained in popularity" because: Learning is no longer the province of special institutions: it is a way of being (Watkins, Carnell, Lodge, Wagner & Whalley 2002).

Education systems at all levels are exposed to the demands of various institutions and institutions for the improvement and advancement of work processes and resources. In higher education systems, one of the preconditions for quality is the improvement of teaching, with special emphasis on the proactivity of students and their active involvement. The European Network for Quality Assurance in Higher Education (ENQA) was created with a tendency to ensure the quality of higher education on European soil. The standards prescribed by the ENQA network, the role of students and their experiences in higher education and teaching are singled out as the leading institutional missions in ensuring the quality of higher education. In Standards and guidelines for internal quality assurance (ESG, 2015: 12) it is pointed out that institutions should ensure that the programmes are delivered in a way that encourages students to take an active role in creating the learning process, and that the assessment of students reflects this approach. A special place is occupied by the role of teachers in

presenting selected facts, using materials or using techniques and other means in teaching. Teachers' beliefs and their attitude towards the contents and the ways in which they will present them to the classrooms, shape teaching practices and influence learning outcomes.

When researching the activities of university teachers, Maksić & Pavlović (2019, 68) state that they rely on experiences from their own schooling, whether they want to repeat them or avoid them. With such an approach, teachers develop their own style of teaching and assessment, which is built and re-examined during their careers. Even though a fundamental relationship exists between knowledge and personal epistemological beliefs, research in this area is only just starting to impact on teaching and learning in higher education (Hofer, 2002). Perry (1970) was one of the first researchers to investigate tertiary students' epistemological beliefs. In the context of studying the beliefs of university teachers (Levin & Wadmany, 2005), there are reasonable arguments that information about lecturers' beliefs about teaching can be a way to understand faculty teaching practice (Mataka, Saderholm & Hodge, 2019), according to Pratt (1998, 35) understanding the personal perspective in teaching means shaping a more efficient teacher.

Education of future teachers is also a crucial factor in improving the quality of teaching in practice, and in some papers (Popović & Anđelković, 2019), as an opportunity to encourage domains in the development of professional competencies of students to work in school practice stands out the concept of learning by doing (WIL) which implies the integration of educational activities of connecting academic discipline with practical applications.

However, teacher education is not omnipotent, and does not provide all the necessary competencies for successful work in teaching, and high efficiency cannot be expected from beginners, lecturers in teaching. Just as most people do not become successful in driving, immediately after obtaining a driver's license, but primarily through persistent and patient practice, so a good lecturer does not appear immediately after the first days of formal education or after a few months spent in teaching. An extremely small number of so-called natural teachers, who from the first day of classes do not cause anxiety, sometimes discomfort or personal re-examination. Professional dedication, work and desire of teachers are essential motives for initiating effective teaching, of any level.

Today, there is a growing tendency for more efficient approaches in higher education teaching, aimed at developing benefits for students and improving their learning outcomes, and as such, they are one of the possibilities to encourage and achieve quality. Research results on higher education from Croatia (Nikčević-Milković, 2004: 52) show that students are satisfied with the teaching process that is active, collaborative, practical, critically oriented and creative, supporting active learning that is relaxing, creative and effective. Starting from the fact that each group of students is characterized by specifics that represent significant factors influencing the work of teachers, and thus the choice of teaching strategies, the research focus and goal are focused on the analysis of components of effective teaching. It is necessary to harmonize the interests of students with practice and learning from and for life. The specific question to be addressed in this paper is: How teachers and students shape and influences on concept of effective teaching?

Learning for Life is an idea and experience that involves learning from a number of different sources. It involves a mixture of academic knowledge and life skills, which are necessary for life, and teaching must also focus on developing the ability to act.

Effective teaching can be called teaching in which the lecturer recognizes and applies teaching strategies that meet the individual needs and abilities of students while initiating their proactivity and participation. Perhaps one of the biggest and most demanding characteristics of good lecturers lies in adapting their own strategies to different groups of listeners and constantly searching for the improvement of work and professional competencies. In this concept of teaching, we must not forget the fact that a good teacher is one who is a student himself!
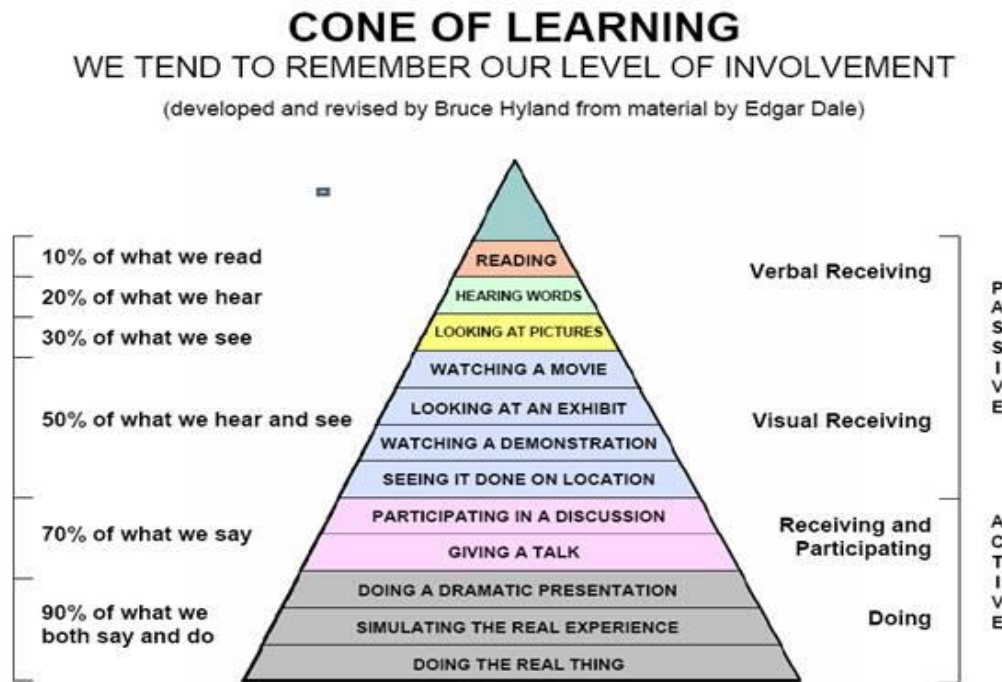
From the initial works of John Dewey (1933), through the concept of reflection and the reflective practicioner Donald Soon (1987, 1991) to the present day, the reflection and reflexivity of teachers have remained indispensable elements in the search for the quality of teaching and teaching practice. Reflexivity is an integral part of the learning and teaching process, which arises through the processes of awareness of personal beliefs and ways of acting in the classroom, where teachers are trained and ready to change beliefs and actions in the classroom, to improve student and personal development. In answer to the question why reflection is defined as the essence of the teaching process, the explanation can be singled out: "if teachers do not develop the practice of critical thinking, they remain trapped in unexamined assessments, interpretations, assumptions and expectations (Larrivee, 2000, 293). This type of "slavery" has a negative impact on improving the quality of teaching and the growth and development of participants.

Theoretical concepts of effective teaching

Since the first forms of formal education, the concepts of good teaching have changed and become more complicated, under the pressure of social circumstances, the development of science and technology, but also pedagogical understandings of individualized approaches to students and respect for their needs by active involvement in the teaching process. Such requirements in teaching, as some of the fundamental postulates of ensuring the quality of teaching, are not recent. Respecting the needs and interests of pupils / students with their active participation in teaching as one of the fundamental postulates of ensuring the quality of teaching, is not a recent idea. In history of education Johan Heinrech Pestalozzi (1746 – 1827) was pioneer of the concept of learning through activity, Friedrich Fröbel (1782 – 1852), students of Pestalozzi, also talk and write about fact that children have unique needs and capabilities. Jan Amos Komensky (1592-1670) pointed out that activity, spontaneity, freedom, self-education and creativity of students are elements of teaching. Much later, John Dewey (1859-1952) stressed the importance of the continuity of learning experiences from schools into the real world and experiential learning: *all genuine education comes about through experience* (Dewey, 1938).

The starting theoretical basis for understanding the way of learning and effective teaching is Dale's *experiential pyramid* developed in 1946. It was further improved by Bruce Hyland in 1969. The American pedagogue Edgar Dale schematically explained the influences of the choice of lecturers when choosing teaching strategies and certain media in teaching on the listeners and their potential learning outcomes (Scheme 2). Also, he spoke about experiences in learning and composed *Dale's Cone of Experience*, which is a model that incorporates several theories related to instructional design and learning processes. He theorized that learners retain more information by what they do as opposed to what is heard, read or observed. Today, this concept is recognized as *learning by doing, experiential learning* or *action learning*. Describing Dale's work Wagner (1970: 94) says: He actively fought for

better schools, academic freedom, civil rights, and other causes long before these became popular issues.

CONE OF LEARNING
WE TEND TO REMEMBER OUR LEVEL OF INVOLVEMENT
(developed and revised by Bruce Hyland from material by Edgar Dale)

10% of what we read	READING	Verbal Receiving	P
20% of what we hear	HEARING WORDS		A
30% of what we see	LOOKING AT PICTURES		S S
	WATCHING A MOVIE		I
50% of what we hear and see	LOOKING AT AN EXHIBIT	Visual Receiving	V E
	WATCHING A DEMONSTRATION		
	SEEING IT DONE ON LOCATION		
70% of what we say	PARTICIPATING IN A DISCUSSION	Receiving and Participating	A C
	GIVING A TALK		T
90% of what we both say and do	DOING A DRAMATIC PRESENTATION	Doing	I V
	SIMULATING THE REAL EXPERIENCE		E
	DOING THE REAL THING		

Edgar Dale, *Audio-Visual Methods in Teaching* (3rd Edition). Holt, Rinehart, and Winston (1969).

Scheme 2. *Audio-visual methods in teaching.* (Dale, 1946)

Dale's Cone of Learning is important, among other things, because it points to the effectiveness of certain teaching methods and confirms that increased student activity through participation, use or facing with experiences and practical application in real situations influences greater achievement of learning outcomes. Cone of learning shows that student can retain only 10% of information provided in oral or written form while the retention capacity of some visual media is 30%. Role play can increase the knowledge retention rate to 40-60%, and the most effective method is the hands-on experience with an 80-90% retention rate.

At the top of the cone, there are the least effective methods while the most effective ones are shown at the bottom. Thus, verbal experiences (reading and listening) are significantly less effective than visual messages, static images, radio shows (audio messages through the media) or film, while the most effective activities are those in which the student participates in discussions and conversations or is involved in practical activities experiments, dramatizations that initiate their research and creative potentials and realize activities in real situations.

Although such a pictorial presentation was made a long time ago, it encourages and initiates the idea of the need for active methods and the active role of students in the teaching process. At one time, although modern technology and multimedia sources were not available to such an extent, Edgar Dale warned that only 30% of what is seen (e.g: video presentations that are often used in teaching) is remembered, if there are no other activities. The exclusive use of modern technology will not give results if the listeners are passive and the developmental needs of young people such as creativity, desire for expression and affirmation or active participation are neglected. If the teacher has ability to recognize the peculiarities of his students, he will respond more successfully to their different

educational needs. It is necessary to have a repertoire of teaching strategies that encourage the engagement and involvement of all participants, which provides the opportunity to express what students know.

Lee Shulman (Lee Shulman, 2004), one of the most cited scholars in the field of education, tried to answer in his works, some important questions concerning teaching, such as:

- ❖ What do teachers need to know in order to teach well?
- ❖ How important is the depth and quality of teachers' content knowledge as a critical aspect of their ability to teach?
- ❖ How teachers can be best educated and how can we assess their achievements as teachers?
- ❖ In what ways is the professional preparation of teachers comparable to the preparation of physicians and other members of learned professions?
- ❖ What kinds of educational research can provide deeper understanding of teaching, learning, and the reform of education?

He often sought answers to these questions in practice, and his works have an impact on both scientists and teachers. His thought: "Research begins in wonder and curiosity but ends in teaching" emphasizes the importance of teaching, but also the strong need to connect teaching practice and research. Schulman is otherwise known for creating the term Pedagogical content knowledge, which is knowledge that is unique to each of the teachers and is based on the way teachers connect their pedagogical knowledge (what they know about teaching) with knowledge from subjects (what they know about what they teach). Integration or synthesis of pedagogical knowledge of teachers and knowledge from their subject includes knowledge of pedagogical content.

Teachers' knowledge of pedagogical content embodies aspects of content that are most natural in its teach ability. The category of knowledge of pedagogical content includes, for the most frequently taught topics from one's subject, the most useful forms of presenting these ideas, the most powerful analogies, illustrations, examples, explanations and demonstrations. - in a word, ways of presenting and formulating subjects that make it understandable to others. . . [It also] involves understanding what makes learning certain concepts easy or difficult: the concepts and prejudices that students of different ages and backgrounds bring with them into learning (Shulman, 1986). Shulman also claimed that Sesame Street was the very best resource for teachers for expanding their pedagogical content knowledge

Learning and teaching are processes that cannot be observed without correlation and mutual influences, so Shulman (2004, 513-517) singled out five principles of effective and long-term learning for students and their teachers:

1. Principle of activity - Students are active all the time. They actively record, research and collect information via computers, talk to each other, share information and challenge each other.

2. Students are not only active, because lonely activity is insufficient for learning. In the learning process, it is important to think about what is being done. Teacher learning becomes more actively active through research and experiments, such as writing dialogue and asking questions. Here he pointed out the necessity for teachers to explore their own teaching. Students think about what and why they do, while teachers give plenty of opportunities to talk about what they are learning. A very high level of carefully guided reflection is mixed with student activities. Reflection is also mandatory

for teachers. Schulman describes activity and reflection as a very difficult job. Reflection is extremely difficult as an independent activity, and therefore introduces the concept of cooperation and mutual teaching. Mutual teaching is the process of improving students' reading comprehension by working with each other, supporting mutual learning, and helping each other to focus, attend, and actively ask questions, critically and reflexively as they read a complicated text together.

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3. At the same time, active and reflective learning introduces a more difficult principle, which is cooperation. When collaborating, teachers work together in ways that support mutual learning. Authentic and lasting learning occurs when teachers and students share materials. They are emotionally committed to ideas, processes, and activities and see the work as related to present and future goals.

4. The same principles that apply to student learning apply to teacher learning, while institutions must be "learning communities" and support activity, reflection and cooperation. Special importance in these communities is given to members who first have something significant to offer to others, but also share expertise with others in the group with respect and trust.

5. Finally, the development of "communities of practice" in which efficiency is shown by the ability to move from story to action, while approaches in teacher education must be used to make teachers active, reflective, cooperative, passionate and public.

Digital students – a new teaching imperative

We may never become true digital natives,
but we can and must begin to assimilate
to their culture and way of thinking.
Rupert Murdoch

The main tendencies in the development of education are characterized by the transition from the model of knowledge transfer to the constructivist model, which gives priority to the personal experience of students (Milutinović, 2016, 7). Young people grow up and live in a digital environment, hence the name digital natives originates (29 ages & under), which refers to members of the younger population whose source language is digital language, computers, video games and internet technologies. In relation to the skills of mastering digital technologies, in contrast to digital natives, members of two other categories are mentioned, namely: digital immigrants (64 ages & under) and digital fugitive (65 ages & over). Digital immigrants are people who have slowly adapted web surfing, emailing, texting, and the instant world of social media. They did not grow up with technology, but they know to use it and integrated into theirs life or work as it necessary. Digital fugitive avoids technology and they belong to populations of people that are seniors, grandparents, senior management, seasoned teachers and anyone else after that generation.

In higher education, we have members of different groups, where lecturers must adapt to their students and choose the most acceptable ways of teaching. Students mostly belong in a group of digital natives, and they have a different ways of thinking and dissimilar educational needs. According to the Kristiansen (2011), the scheme of their way of thinking is presented below.
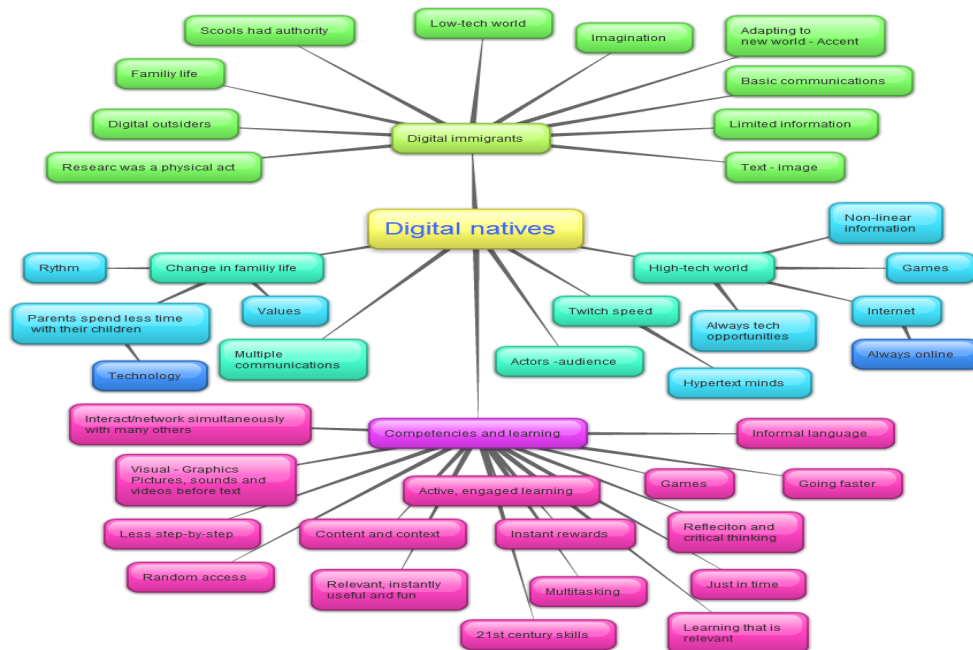
Scheme 3. Digital natives - Thinking map (Kristiansen, 2011)

Times are changing, as well as the needs and interests of students, and the mentioned ones were created under the influence of the environment and the development of technology and formed new groups of students. Therefore, when teaching, it is necessary to think about the needs and changes that have arisen and to shape the teaching practice.

Among other factors in considering the impact on student outcomes of learning, Dale (1969) mentions learning environments should be filled with rich and memorable experiences where students can see, hear, taste, touch, and try. Characteristics of rich experiences according to Dale (1969) are:

- Students are immersed in it and use their eyes, ears, noses, mouths and hands to explore the experience,
- Students have a chance to discover new experiences and new awareness of them,
- Students have emotionally rewarding experiences that will motivate them for learning throughout their lives,
- Students have chances to practice their past experiences and combine them to create new experiences,
- Students have a sense of personal achievement, and
- Students can develop their own dynamic experiences.

In Guidelines for internal quality assurance it is emphasized that student-centred learning and teaching plays an important role in stimulating students' motivation, self-reflection and engagement in

the learning process, and that demands careful consideration of the design and delivery of study programmes and the assessment of outcomes (ESG, 2015:12).

The implementation of student-centred learning and teaching:

respects and attends to the diversity of students and their needs, enabling flexible learning paths;

considers and uses different modes of delivery, where appropriate;

flexibly uses a variety of pedagogical methods;

regularly evaluates and adjusts the modes of delivery and pedagogical methods;

encourages a sense of autonomy in the learner, while ensuring adequate guidance and support from the teacher;

promotes mutual respect within the learner-teacher relationship;

has appropriate procedures for dealing with students' complaints.

In teaching is always good to keep in mind, Delors' (1996) four pillars of learning are seen as fundamental principles for reshaping 21st century education. Lifelong learning organized into four pillars: *learning to know*, *learning to live together*, *learning to do*, and *learning to be*.

Learning to Know involves the acquisition and development of knowledge and skills that are needed to function in the world. Examples of skills under this pillar of learning include literacy, numeracy, and critical thinking.

Learning to Live Together involves the development of social skills and values such as respect and concern for others, social and inter-personal skills and an appreciation of the diversity among people. These skills would enable individuals and societies to live in peace and harmony.

Learning to Do involves the acquisition of skills that would enable individuals to effectively participate in the global economy and society. These skills are often linked to occupational success, such as vocational and technical skills, apprenticeships, and leadership and management competencies.

Learning to Be involves activities that promote holistic personal development (body, mind and spirit), for an all-round 'complete person.' These include cultivating one's self analytical and socials skills, creativity, personal discovery and an appreciation of the inherent value provided by these pursuits. An example under this pillar is a teacher who participates in training workshops that will enhance his/her knowledge and skills in the teaching learning process (Delors 1996). This pillars are universal for all students and teachers, represented the beginning and outcome of teaching.

Teacher in teaching aspects

> *"The mediocre teacher tells. The good teacher explains.*
> *The superior teacher demonstrates. The great teacher inspires."*
> *William Arthur Ward*

Among other, the affiliation of a lecturer to a certain system of education, school or higher education, affects the existence of differences in beliefs, and thus the ways of working. Kember (1997) pointed out the differences between university and school teachers, as well as the fact that universities work according to completely different value systems and traditions in relation to schools. There are differences between the beliefs of school and university teachers in other authors (Yero, 2002, xii),

pointing out that many teachers in schools are less interested in research studies than in practical ways to improve their teaching experiences. In the literature (Fives & Buehl, 2016), three sets of beliefs are cited as key to teaching practice: beliefs about teaching, beliefs about knowledge (epistemological beliefs), and beliefs about student abilities. It is necessary that the teaching process is directed towards the listeners and that the differences in relation to the groups in front of the lecturer are taken into account.

What makes a teacher good at teaching, what qualities define him as a great teacher who inspires? It is almost certain that the subject knowledge they possess makes up only one part of the complex mosaic in the spectrum of required teacher characteristics and actions. On the Edutopia website, 11 habits of an effective teacher have been developed:

5 Scheme 4. 11 Habits of an Effective Teacher (Edutopia, 2014)

Evidently, digital students are not sufficiently motivated for traditional ways of teaching and working, it is necessary to adapt ways of working to new requirements of the time, conditions and needs of listeners. The mentioned differences, whose existence is significantly influenced by the digital environment, separates teachers and students into separate groups. Pinter (2016) tabulated the differences between digital natives in which he categorizes pupils / students and digital immigrants - teachers (Table 1).

Digital Native Learners	Digital Immigrant Teachers
Prefer receiving information quickly from multiple multimedia sources	Prefer slow and controlled release of information from limited sources
Prefer parallel processing and multitasking	Prefer singular processing and single or limited tasking
Prefer processing pictures, sounds and video before text	Prefer to provide text before pictures, sounds and video before
Prefer random access to hyperlinked multimedia information	Prefer to provide information linearly, logically and sequentially
Prefer to interact/network simultaneously with many others	Prefer students to work independently rather than network and interact
Prefer to learn Just -In- time	Prefer to teach Just-in-case (Its only exam)
Prefer instant gratification and instant rewards	Prefer deferred gratification and differed rewards
Prefer learning that is relevant, instantly, useful and fun	Prefer to teach to the curriculum guide and standardized text

6 Table 1. The Differences between Digital Native Learners and Digital Immigrant Teachers (Pinter, 2016: 681)

The essence and meaning of the teaching profession are most closely determined by the processes of teaching and learning. Day (1999: 22) argues that 'teaching is more than a craft', suggesting it is an 'educational science and a pedagogical art'; Teachers face a challenging landscape that is in constant flux (Gregory & Chapman, 2013: 3). As factors influencing teaching, various aspects of teaching work, characteristics and behavior are singled out: Hargreaves (1995: 9) draw attention to the importance of purpose, passion and desire in teaching; Borko & Putnam (1995:36) considered knowledge as key construct and it is particularly relevant to understanding classroom practice; Živković (2018: 5) emphasizes the professional and personal identity of the teacher, pedagogical tact and professional development. In addition to the existing influences directly related to the teaching process, the family and life circumstances of teachers, free time, school ethos are listed, while those who are in the teacher and the desire to learn, improve and enhance their own and students' potentials are defined as determining (Anđelkovic), 2017, 137–138).

Recent research (Gregory & Chapman, 2013: 3) shows the mindset of teachers who are differentiating in their classrooms embraces the following ideas:

- All students have areas of strength.

- All students have areas that need to be strengthened.

- Each student's brain is as unique as a fingerprint.

- It is never too late to learn.

- When beginning a new topic, students bring their prior knowledge base and experience to the learning.

- Emotions, feelings, and attitudes affect learning.

- All students can learn.

- Students learn in different ways at different times.

Findings based on empirical results (Hashweh, 1996, 48) confirm that constructivist teachers have a richer repertoire of strategies compared to nonconstructivist teachers and that they seek to use teaching strategies that are potentially more effective in fostering conceptual change.Gurney (2007: 91) in the creation of an effective learning environment, suggest that it is the interaction of the following five key factors that provide a foundation for a good teaching:

- Teacher knowledge, enthusiasm and responsibility for learning.

- Classroom activities that encourage learning.

- Assessment activities that encourage learning through experience.

- Effective feedback that establishes the learning processes in the classroom.

- Effective interaction between the teacher and the students, creating an environment that respects, encourages and stimulates learning through experience.

Although teaching is a process that has existed for centuries, the vision of a good teacher is not always the same. Namely, teachers are often exposed to the pressures of social circumstances, technological processes and numerous demands. There are a large number of factors in the teacher that affect the effectiveness of teaching, such as the teacher's beliefs or the degree of reflexivity.

Indicators of effective teaching

Is a quiet indicator of the listeners' lack of interest in the topic? Can effective teaching be "mute"? How to check your own achievement in teaching? How to know if teaching methods and ways are adequate? Indicators of good transmission are different, one of the most important can be considered feedback from listeners, but if it is not there or the lecturer can not get it, there are indicators that the lecturer can assess. (Example of scheme 5)
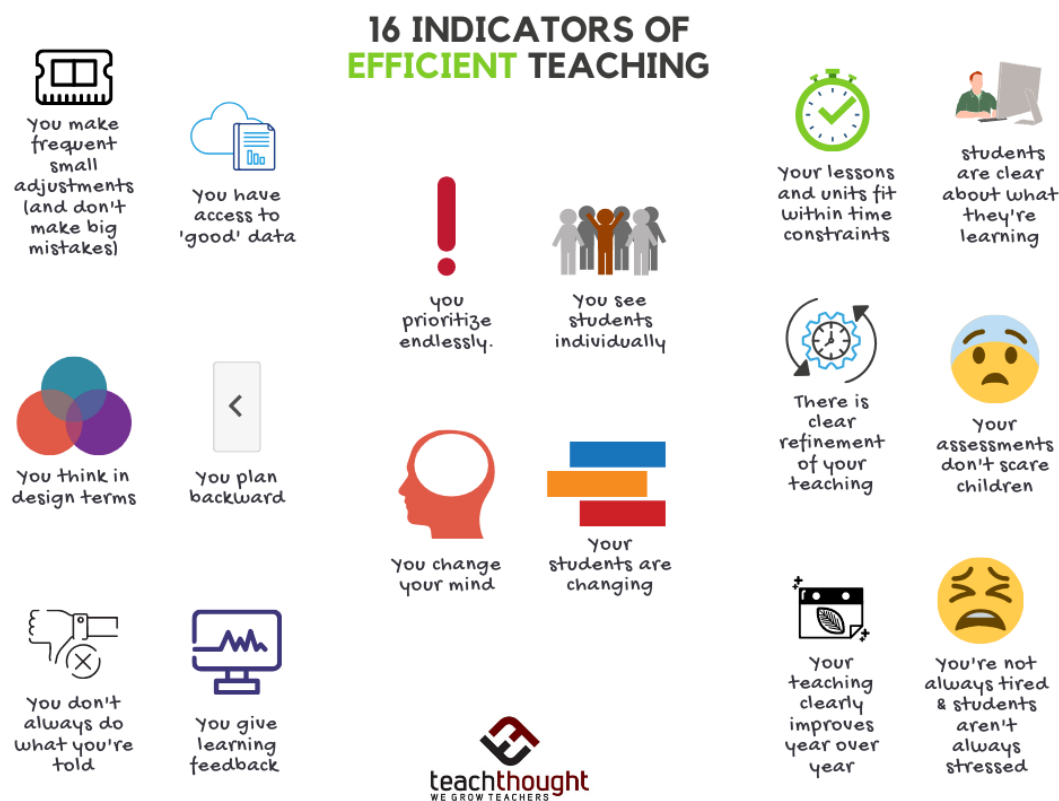
7   Scheme **5. 16 Indicators of Efficient Teaching**

A more skilled and skilled lecturer, he always follows the non-verbal signs of his listeners, such as:

- kinetic (position - body language),
- paralinguistic (signs that show not what, but how something is said)
- proxemics signs (distance, use of physical space)
- facial expressions, gestures
- down to the way you dress and the little details

Research data with students from Pakistan (Sajjad, 2010) on methods in higher education support the following: 1. Lecture Method 2. Group discussion 3. Individual presentation 4. Assignment 5. Seminars 6. Workshops 7. Conferences 8. Brain storming 9. Role play 10. Case study. Most of the students rated lecture method as the best teaching method. The key reasons for this student decision

were teacher provides all knowledge related to topic, it is time saving method; students listen lecture attentively and take notes etc. The group discussion was rated as the second best method of teaching because of; more participation of students, the learning is more effective, the students don't have to rely on rote learning, and this method develops creativity among students, etc.

Practical implications for effective teaching - How to reach…?

How to get the student voice, mentioned in the Introduction, which alludes to the fact required by students to make the teaching process… active, collaborative, practical, critically oriented and creative, supporting active learning that is relaxing, creative and effective. Some of the ways are mentioned through the work, but it is important to emphasize: the teacher's reflexivity, which he examines and evaluates his own work, feedback from students (feedback) on teaching methods, selection of adequate methods that meet the specifics of the audience, constant professional development of teachers created innovations in the environment, with respect for both digital resources and socio-emotional components of learning and teaching. One of the obligations of the lecturer is to think about the so-called KWL chart (Kumar, 2107), which indicates that before starting any topic it is necessary to check the previous knowledge, because the logical sequence of linking the content is possible only if there is previous knowledge, especially in the fields of natural sciences or grammar. The willingness of lecturers to assess the capacities of their listeners is necessary for effective teaching, and it is achieved through simple teaching techniques, such as:

- Solving interesting tasks from the previous classes,
- Creating reminders in the current lesson about what has been learned,
- Asking intriguing questions in the introductory part of the lecture,
- Organizing a debate on previous content,.
- Reading inspirational materials,
- Individualized tasks, and then pairing or grouping for work,
- Instructing intentional breaks,
- Observation of non-verbal behaviours,
- Discussion and debate on the topic,
- Application of the topic in life situations,
- Recapitulation of the topic with various incentive activities,
- Assigning incentive tasks for the upcoming classes (individually or through project activities)

Conclusion

All of the above confirms the fact that a good teacher is the key to teaching, but in order to become effective, it is necessary to respect the needs of students and use active methods that encourage students to get involved and learn.

If we considered Dale's research, and considerations of other mentioned authors in the paper, the most effective method is one in which students involves directly (participating, doing or

stimulating). *Learning by doing* and *Learning with experiences* in real situations, are key for better learning of students. It reveals that "action-learning" techniques result in up to 90% retention of contents. Hattie (1999: 9) provides his conviction that always believed that feedback – focussed, appropriate, timely and learning related – should be one the cornerstones of the effective teacher. Hattie's extensive research highlighted the value of feedback in raising achievement. He identifies feedback as 'the most powerful single moderator that enhances achievement' (1999: 2).

Taking into account these postulates, it can be determined that it is best to learn with: active participation of participants, Incentive methods in class (experience and involvement), demonstration of what has been learned, application of life examples.

Effective teaching is a type of educational challenge that the teacher needs to think about on a daily basis, thus reflecting and creating new connections and relationships with students through initiation. Whether the work is completely individualized or cooperative, there remains a need to use active methods of work.

Summarizing the presented data and facts, some important issues for the teaching process should be singled out:

1. As research has shown, effective teaching is based on a number of similar postulates and ideas expressed earlier, through pedagogical history and ideas.

2. Time, human and social progress create different conditions and possibilities for teaching, so that the set postulates represent variable possibilities for teaching, and not universal means.

3. Effective teaching does not forget or leave out the student as its determinant for achieving outcomes.

4. Students' experiential activities using experience and learning through examples are indispensable in order to achieve quality in teaching and improve student learning outcomes.

5. The teacher influences the design of teaching with his own beliefs, reflexivity and teaching methods.

6. Student involvement and experience are powerful resources for advancement and better learning outcomes.

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QUESTIONS:

Why is math considered as a boring subject?

How can the acquisition of productive, functional knowledge be supported?

How can math be learned in an interesting way?

Which innovative and interactive methodical procedures should be implemented in teaching math?

Teaching methods in university settings
How to teach students how to learn

Contents

Introduction

Mathematics, as a basic science that uses numbers and signs, i.e., their sequence in accordance with regulated numerical principles, is often seen as a hard to master and difficult subject, a subject that cannot be easily learned. Although it provides a broad framework for understanding logical thinking, provides knowledge that encourages inventiveness and "unlocks" the hidden corners of an individual's unique mind, it still remains a subject that is not too popular among students. The question arises: Why is this so?

It seems that at least one part of the answer can be found in the assumption that most of our formal education begins and ends with the dominant application of traditional teaching methods. This is especially evident in the lower grades of primary school, and is strongly related to the teaching of mathematics. Frequently, this trend continues through higher levels of education. In the study programs that prepare future teachers of mathematics and other natural sciences, subjects focused on pedagogical, psychological, didactic and methodical training of teachers are insufficiently present, which results in partially developed professional competencies necessary for quality teaching. This is quite pronounced when talking about the application of innovative methodical procedures in teaching. Simply put, in a conventional classroom that is lacking interactive method, learning abilities are limited, cramped, and reduced to "copying" what is written on the board, which ultimately leads to the ultimate "inability" of students to effectively manage data by thinking, evaluating, and researching. Precisely because of such reduced intellectual abilities, students stagnate and lose interest in learning. How can we help them to learn productively?

By considering modern trends and perspectives of education development, as well as numerous initiatives that have been started, the solution can be found in an innovative pedagogical-andragogical

approach that strives for teaching based on activities, interaction, and methodological strategies, procedures, tools and techniques aimed at greater involvement of users of educational services. Interactive instruction based on methods in which the key activities are taken over by students themselves is actually a type of instruction in which the teacher focuses on the application of different teaching strategies that would be implemented through an action in which students are encouraged to show interest and which allow both efficient and effective learning practices to be achieved. It is based on the application of such teaching methods through which every individual with whom the teacher works gets involved willingly, and is both rationally and physically interested and engaged. In such processes, students have the opportunity to create mathematical ideas through dynamic contribution, creativity, using all their thought processes and operations according to their level of development and current capacities. This does not mean that traditional teaching methods should be completely eliminated from teachers' practice, but that the quality of teaching and learning can be achieved by their careful selection and combination with modern, innovative interactive teaching methods wherever possible and applicable. Based on this understanding, this paper gives a brief overview on some modern teaching methods that can be applied in mathematics instruction, with an emphasis on the university context.

Innovative and interactive methodical procedures in teaching mathematics and natural sciences

It is well-known that interactive teaching is a way of teaching in which teachers initiate and encourage student participation in the learning process through teacher-student, student-student interaction, application of audio-visual materials, multimedia content, and practical demonstration. Students are constantly given support and encouragement to participate. In the process of modern education and teaching, the interaction between key participants in the learning process is very important, and from a pedagogical point of view, interaction should not only be seen as a modern trend but also a basic principle of modern teaching. Whether it is about mathematics instruction or some other subject, the success and quality of teaching and learning will directly depend on the quality of the established interaction between users of educational services and other elements of the teaching process.

We are witnessing that in today's environment prone to change and uncertain circumstances, the paradigm shift from traditional to modern is emphasized, and in the educational context it would imply a gradual transition from the traditional way of teaching and learning to a much more active, student-centered approach who would as a result develop the skills necessary to functioning in the 21st century. Of course, such a shift cannot happen overnight, and it puts significant demands on teachers, especially in terms of possessing innovative teaching skills that would enable them to actively participate in the learning process. In this regard, it seems true that the quality of educational services provided by teachers to their users largely depends on their competencies, which are read in terms of theoretical and practical knowledge, pedagogical, didactic and psychological skills, as well as skills related to adequate application of modern information and communications technology in the classroom.

Many studies conducted in the last decade have suggested the existence of innovative teaching approaches that could be added to a wider range of teacher roles and tasks, and which could very well

be used as a way to improve or supplement traditional teaching methods. At a highest level of education, it is an innovative pedagogical-andragogical approach that can be understood as a proactive approach that seeks to integrate teaching strategies and methods in working with students in the most creative way possible. The essence of this integration is reflected in taking full responsibility of the one who learns for his own learning with an active effort to achieve his/her own goals. At the same time, the role of the teacher is the role of mediator or facilitator in achieving the intended goals. Certainly, this is a creative implementation of adequate learning methods and materials for the benefit of those who learn, i.e., the quality of teaching and learning. And in order for this process to be beneficial to students, it is important to effectively and efficiently combine the right teaching and learning methods with a variety of materials and techniques to help teachers improve their students' learning skills.

The focus of this innovative approach is based on the belief that each student can improve capacities to learn and to be successful in the learning process. Therefore, teachers should view each participant in educational activities as a unique human being of certain personal characteristics that can be shaped and refined by applying innovative methodical procedures in teaching.

In higher education, the practice of such innovative pedagogical-andragogical approach affects the intensity and extent of student engagement, motivation and critical thinking. Speaking about mathematics instruction and related subjects, it is clear that the specific characteristics of these scientific fields require constant search and examination of efficiency and effectiveness, as well as the applicability of some teaching methods. Later on in this paper, only some of the teaching methods are presented, which are characterized not only by innovation but also by interaction, i.e., it is shown that their application in such specific areas, such as mathematics, can allow for high quality teaching and learning, and most importantly active student participation. The main focus of the paper is on the description of the training material which represents only some of the possible examples for conducting training activities in preparing teachers for the application of innovative teaching methods. The described brief theoretical review of some teaching methods is the starting point and orientation by which the trainer is guided in presenting the essence and significance of each of the selected methods, and the activities presented in the scenario are realized through workshops and collaborative approach using modern educational tools and on relevant contents (from math and other natural sciences). A total of 425 hours of active work is planned for the described activities: two double lessons and two triple lessons. The scenario of training activities is given after a short theoretical background of the selected teaching method.

Problem-solving method

By implementing the problem-solving method and thus the problem-based learning model, students shift from passive recipients of information to active, free, autonomous, largely self-directed participants in solving intellectually challenging situations. Compared to many other methodical procedures and strategies that begin with the presentation of material and then ask students to apply discrete knowledge to solve a predefined and well-defined problem, this methodical procedure begins with an open, authentic problem that requires students or groups of students to identify what they know, and what they need to know to solve the problem situation, to determine how they can acquire the necessary knowledge, formulate assumptions, define solutions and report on what they have discovered. Many authors suggest that the problem-solving process consists of four steps that can improve student

motivation and strengthen successful thinking habits: (1) understanding the problem, (2) devising a problem-solving plan, (3) executing the plan, and (2) reviewing problems and solutions. However, there are those like Hu and associates (Hu *et al.*, 2018) who state that it is clear to teachers that designing and implementing an effective problem-solving plan by students is not such an easy and simple job, and suggest an improved version of problem-oriented teaching methods in six key steps based on existing theoretical assumptions.

Table 1. 6-step problem oriented teaching method (Hu, Xsing & Tu, 2018: 1696)

Step	Problem-solving teaching	Details
1.step	Cognitive problem	What the question means? What are you looking for the answer? What are the concepts, theorems and formulas involved in this problem? Do you understand them?
2.step	Analysis problems and solving it	Have you ever had a similar problem? (1) If the answer is "Yes", what is that problem? What is the solution of that problem? Is it helpful to this problem?(2) If the answer is "No", what do you think of the present condition of the problem? What can you deduce or calculate? What is the ultimate solution to the problem? Then, you can ask your teachers and classmates to help you solve the problem.
3.step	Summary results	After the solution of the problem, what kind of theoretical knowledge is used in this method? Including concepts, theorems, formulas, etc...Are you familiar with this knowledge? If you are not familiar with, review again.
4.step	Method extensions	What other problems can be solved by this method? Can you solve a similar problem?
5.step	Method comparisons	Is there any other way to solve this problem? What are the advantages and disadvantages of these methods?
6.step	Sum-up and increasing	After solving this problem, what have you got? Including knowledge, methods and other aspects.

When placing a problem situation it is recommended to form a group of 2 or 3 students who would jointly collaborate and discuss about the problem and issues that occupy them and are focused on a problem itself. By being faced with the problem situation, by gathering the necessary information about the given problem, exchanging information, experiences, and communicating with other groups, and searching for adequate solutions, students are given enough opportunity to gain new knowledge, to engage mentally and thus prevent boredom. The knowledge acquired in this way has a special place within a significant context. The role of teachers is to be promoters, those who assist, help, remind and guide students in the processes of critical thinking. Students are also encouraged to seek help from multidimensional sources.

Problem-based learning is a demanding but valuable and useful interactive strategy for both teachers and students, as solving the problem requires systematic planning of steps to achieve the goal, and giving students the opportunity to approach the problem from the position of true professionals, to be holistically empowered and it also promotes the process and self-directed learning capacities. The benefits that students have are numerous, and most importantly they perceive the problem as an obstacle or dilemma that can be overcome and eliminated by their own efforts, and thus learn how to behave in

new situations, develop independence, gain enthusiasm and confidence for future problems, and they also introduced to real life situations. Of course, it is important to mention that in the educational group facing the problem, there will always be those who do not belong to the group of convergent thinkers who focus on the same, that is, not all will belong to the category of problem solvers.

Apendix 1. Scenario of training activities - Problem-solving method in math teaching

Project	Strengthening Teacher Competencies in Higher Education in Natural and Mathematical Sciences
Training	Teaching methods in university settings: How to teach students how to learn
Topic:	**PROBLEM-SOLVING METHOD**
Contents:	- Problem-based learning and teaching model; - Didactic, psychological and epistemological value of problem-based learning; - Didactic qualities and outcomes of effective application of problem-solving method in teaching; - Constructive resolution of problem situation within 6 phases; - Creation of problem-solving model in math teaching;
Aims of training:	- Knowing the essence problem-oriented teaching and design their own models of problem situations; - Understanding problem-solving stages; - Applying problem-solving method in teaching mathematic contents; - Demonstrating problem situations in direct teaching practice.
Training outcomes:	After realization of training, the participants will be able to: - Know basic elements, rules and principles of problem-oriented teaching and develop own models of math problem situations; - Know, connect and interpret basic stages of problem-solving; - Solves the problem using the acquired knowledge and skills; - Implement problem-solving method in teaching analog mathematical contents; - Demonstrate the correct application of problem-solving method in direct teaching practice.
Form of work	Group, Individual and Frontal
Teaching methods	Demonstration method (demonstration of activities), Oral presentation method (description, clarification, explanation), Conversation method, Method of practical works
Teaching tools	IdeaBoard (or Flipchart), knowledge clip, coloured pens, coloured papers, poster, pictures, laptop, projector, educative comic… Teaching materials: - Hu, Y.H, Xing, J. & Tu, P.L. (2018). The Effect of a Problem-oriented Teaching Method on University Mathematic Learning. *EUROASIA Journal of Mathematics, Science and Technology Education*, *14*(5), 1695-1703. - Mrayyan, S. (2016). Teaching Methods for Developments of Mathematic Teaching of Math, and Methods Teaching Mathematics College Students. *American Journal of Educational Research*, 4(2), pp. 147-149. doi: 10.12691/education-4-2-1

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Training design	Mastering this topic implies structuring the training in several key parts in accordance with the stated contents. At the same time, these contents can be understood as a reference point according to which both organizational and time articulation will be defined. The duration and flow of the training itself is defined and briefly described in the text below.
Topic	Problem-solving method in math teaching
Content overview	Problem-based learning and teaching model; Didactic, psychological and epistemological value of problem-based learning; Didactic qualities and outcomes of effective application of problem-solving method in teaching; Construcitve resolution of problem situation within 6 phases; Creation of problem-solving model in math teaching.
Activity plan	(total duration 90 minutes)
Introductory activities: **10 minutes**	After introducing himself, the educator makes a short oral introduction to the topic of contemporary teaching methods with the main focus on problem solving method and problem-based teaching na learning (the essence and basic characteristics). The educator asks each participant to write the first association on the word "problem" in the first section of a specially created board (Ideaboardz or on colored paper by sticking stickers). After this activity, the educator uses video beams and presenters to show interesting illustrations of different conditions of students when facing a problem situation and teachers who organize classes using the method of solving problems in different sciences. Participants should describe in one sentences, as credibly as possible, what they saw in each of the pictures shown. For this activity, they present their descriptions on paper or on electronic stickers in the second section of the electronic board postwall. Participants are asked to imagine the period in which they found themselves in front of the biggest problem that they need to solve and give a vote to the association or sentences in sections that best describe the situation in which they found themselves. This activity will serve the educator to point out, together with the participants, on the psychological, epistemological and even didactic values of problem-based learning. Participants are asked to explain what these associations and the images shown tell us. A short summary by the educator emphasizes the importance of designing and using the method of solving problems in the teaching of all sciences, especially mathematics, which with many of its contents is suitable for the application of this methodical procedure.
Central activities: **60 minutes**	**First part** (10 minutes): The educator plays a self-created animated video called "Math detective" via laptop and video beam (an educational story with real-life and some imaginary situations on the film that contains a mathematical problem that needs to be solved). After setting the bait, halfway through the film, the

	educator stops the recording and asks the participants to divide into groups. Presented video aims to arouse the intellectual curiosity of the participants and the desire to solve problems but not to get ready-made solutions. Participants are explained that they will work in groups to solve a given problem and that it is necessary for them to share roles - group leader, illustrator, presenter… **Second part** (30 minutes): Although working on solving the same problem, the groups are expected to approach the task in their own way and by mutual agreement. The educator provides help and additional information to the groups, and releases the film if it deems necessary. Each of the groups should explain their solution in detail, describe all implemented activities that led to solving the problem as well as those that led to the wrong solution, and create their own solution scheme (through an interesting illustration, scheme, graph, mental map). The aim of the group work is to introduce the participants to 6 phases of solving the problem situation through the demonstration of a mathematical problem presented through unusual life situations in the form of a film. **Third part** (20 minutes): Each group should define key issues in problem solving. The educator then initiates a short debriefing asking the participants to arrange the logical sequence of questions. Through a self-created poster, the educator points out the guidelines in solving the problems that need to be adhered to, and by releasing the rest of the film, he leads the participants to the final solution of the problem. After the end of the film, the educator shows a self-created educational comic strip of problem solving phases with a brief review of the explanation of each of them.
Ending activities: **20 minutes**	Based on analogous mathematical contents, the groups are expected to devise examples of problem situations and a plan of activities for their implementation in direct teaching. Every group presents their plan.

Mapping method

The application of mental mapping in teaching mathematics seems to be a very flexible methodical method but also an auxiliary teaching tool that can be combined with many teaching methods since it can be very easily adapted to adequately describe many mathematical tasks and concepts. Mental maps are a valuable resource and help in problem solving, research, memorization, attention maintenance, motivation, organization, and even brainstorming. This methodical strategy results in mutual benefits because, as it provides assistance to students to learn, it also helps teachers to transfer content more effectively to students.

Mental mapping is a substantial network of brainstorming ideas whose data branch out into related topics. Through pictures, diagrams and photographs, students can organize their thoughts faster and more successfully. It is crucial that students use images and other visual aids to organize content and master it and mentally store it, which certainly has multiple advantages in terms of memory over using only words and text. These mental patterns (plans, maps) differ from other types of records because they eliminate their linear nature and transfer information in a natural way so that the brain can easily process and retain it. We could agree with Kontrova (Kontrova, 2014) who suggests that mind maps are a means of presenting ideas and concepts related to the topic in a well-structured form. She

points out their valuable suitability as a pedagogical tool in mathematics education, especially when it comes to building mathematical structures. It turns out that knowledge maps, such as mind maps and concept maps can be effective tools for building structures in mathematics. One of the well-known pedagogical experiments, which included the inclusion of mind maps in lectures from the subject Mathematics with students of the Faculty of Civil Engineering, was conducted by Kontrova. Based on the obtained results, she came to the conclusion about the positive influence of the implemented mind maps in mathematics teaching. The students realized that the maps significantly enabled them to create a system in a multitude of information, facts and concepts and get an independent view of the analyzed topics and the accompanying contents. Also, through mind maps, they were given the opportunity to make observations, revise, control and direct their own learning process and thus develop their own meta-cognitive learning strategies.

For those who prefer more complex mathematical content, this methodical strategy is especially beneficial where formulas, types of numbers, theorems, etc. need to be reproduced. It is actually based on notes, especially when students are presented with too many facts, data and figures that are hard to remember. It includes writing down the most important information and keywords in order to create a connection with ideas and facts or to generate more ideas and connect them with the radial structure of topics, parts and main paragraphs (writing essays for example), reducing content through mental mapping reduces notes to a minimum number and range. In solving mathematical problems, mind mapping certainly helps to initiate more possibilities and solutions, to perfect the plan in order to obtain the most realistic and practical solutions. Thus, mapping allows students to focus on a number of possibilities and then select the best and fastest solutions. It is also used in mathematical presentations in order to avoid "overcrowding" with formulas, equations and identities that need to be presented, so it is enough to show by mental mapping only the necessary images and keywords to stimulate memory and get more space for conversation and contact with students, because such graphical presentation is just a backup and a good illustration of the teacher's words. It is valuable to point out on some of the functions of the mapping method, which relate to both students and teachers. Thus, for example, mapping for the student has an auto diagnostic function in the sense that the mind map allows him/her to explicitly get to know his/her creative and cognitive arrangement on the discussed topic. Also, there is an opportunity to monitor the process of self-learning, which contributes to the development of meta-cognitive abilities of students. On the other hand, a diagnostic function is imposed for the teacher because the mind map is a tool for identifying situations in which it is necessary to make a decision on the nature of pedagogical intervention and among other things a diagnostic tool for identifying levels of understanding new concepts of individual student or whole group of students. Finally, there is the intervention function, which actually refers to the application of the mapping method as a content-organized support in the learning process which ensures the meaningful integration of new knowledge into already existing cognitive structures.

Project	Strengthening Teacher Competencies in Higher Education in Natural and Mathematical Sciences
Training	Teaching methods in university settings: How to teach students how to learn
Topic:	**Mapping method**
Contents:	- Mental mapping as a tool for learning and stimulating memory - visualization of thoughts and ideas; - Structuring mental mapping - key elements and relative importance of individual parts; - The use of mental mapping in the daily preparatory work of teachers and in realization of lectures; - Combining mental mapping with other methodical procedures; - Creating a mental map using modern internet tools.
Aims of training:	- acquainting the rules and principles of making a mental map; - knowing and understanding the structure of the mental map - its constituent parts and their association; - mastering a technique of mental mapping; - application of mental mapping method on mathematical contents; - presenting and interpreting information (pictures, diagrams, charts) from mental maps; - mastering the technique of mental mapping with the available inovative educational tools.
Training outcomes:	Participants are expected to be able to: - analyze the presented mind maps, recognize and connect the main elements; - understand how to apply mental mapping in different situations; brainstorming, decision making, solving mathematical problems, writing reports, designing projects, preparing for class, conducting lectures ... - synthesize and integrate information, key ideas and concepts; - model their own mind maps based on acquired knowledge; - explore additional information and master various web-based tools for creating mind maps.
Form of work	Frontal and Group work
Teaching methods	Oral presentation method, Demonstration method, Method of text reading and analyzing, Mapping method, Brainstorming...
Teaching tools	- Flipchart, mind maps (https://share.ayoa.com/mindmaps/e3c72304-db71-4ed1-981a-6833ee67a848), coloured paper, stickers, coloured pens, pictures, PowerPoint presentation, laptop, projector… *Teaching materials:* - Buzan, T. (2005). Mape uma [*Mind maps*]. Beograd: Biblioteka UM. - Kontrova, L. (2014). Mind Mapping as Efficient Tools in Mathematics Education. *Communications*, 3, 73-78. - Loc, P. N. & Loc, T. M. (2020). Using Mind Map in Teaching Mathematic: An Experimental Study. *International Journal of Scientific & Technological Research*, 9(4), pp. 1149-1155. - - Stanković, N., Ranđić, S. (2008). Primena mentalnih mapa u nastavi [*Mind Map Application in Teaching*]. U D. Golubović (Ur.), Zbornik radova sa

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Training design	Through this training, great opportunities will be given to participants to get acquainted with different modalities of mental mapping and the requirements for making mind maps, from those simpler to more complex maps. The contents covered by the training are structured so that in the first part of it, the participants get acquainted with the basic requirements in mental mapping through demonstrations by educators, in the second part they work on creating their own mental mapping project on a given math contents and with the help of materials prepared by the educator, while in the third part, they will be introduced to some new software solutions for mapping and mastering the technique of mental mapping with the help of modern technology. The main focus is to bring to participants a closer picture of how to use mind maps in teaching for brainstorming, problem solving, decisions making, planning, deriving key ideas and notes from printed materials, and adequately presenting the information contained in them. By applying this methodical procedure, participants will be familiar with some of the basic advantages of mental mapping in the teaching process: support for learning, adoption of content at an advanced level, association between facts and ideas and improving creative problem solving, but also introduced to some available tools for creating mental maps.
Topic	Mapping method
Content overview	- Mental mapping as a tool for learning and stimulating memory - visualization of thoughts and ideas; - Structuring mental mapping - key elements and relative importance of individual parts; - The use of mental mapping in the daily preparatory work of teachers and in realization of lectures; - Combining mental mapping with other methodical procedures; - Creating a mental map using modern internet tools.
Activity plan	(total duration 90 minutes)
Introductory activities: **20 minutes**	The educator starts the presentation *Tips and Tricks in Mental Mapping* and through a short lecture introduces the participants to the basic characteristics of mental mapping, elements of its structuring and ways of their integration into the map. By presenting different models of mental mapping made in several software tools, the educator introduces participants to innovative ways of organizing and creating mental maps in different domains of work. The main aim is to familiarize participants with the essence of this methodical procedure, the advantages of its application in teaching (especially in mastering mathematical content), as well as other areas of work, using for various purposes, and also the effectiveness of mental maps. In addition, it will be pointed out that combining mapping with other methodical procedures has a positive effect on the learning and

	memory of students, and the teacher himself in his preparatory work, as well as in the stage of realization of the lesson.
Central activities: **50 minutes**	After the presentation, the educator divides the participants into groups. Before distributing work materials and assigning tasks to groups, educator launches a mental map titled *"Famous Mathematicians"* self-created in the Ayoa application (https://share.ayoa.com/mindmaps/e3c72304-db71-4ed1-981a-6833ee67a848). The map is unfinished (half-complete) and the participants are given the task to based on the presented map make the missing parts. In order to be able to answer to this, the educator distributes to each group printed materials and at the same time they can use electronic sources and search them. Each group received printed material with one well-known scientist who made a significant contribution to math in a certain period of time. While the groups are working, the educator places the same map on a large poster on coloured paper for drawing, and when a time planned for the realization of task has expired, the representatives of each group can manually draw their part of the map following the principles and rules of creating maps. The map is structured on that way that one part of it represents the achievements and contributions of mathematicians from early periods and the other part from modern times. Participants will have 30 minutes to read, prepare and complete their task. After that, each group comes to a large poster and draws a part of the map for which they are in charge, and with the help of the educator, glue up pictures of the main discoveries of mathematicians.
Ending activities: **20 minutes**	In the final phase, the educator demonstrates to the participants in a few short steps how to create a mental map in the web-based software *MindMeister* that can be run from any web browser (https://www.mindmeister.com/).The educator instructs the participants on the existence of certain shortcuts that can be used in order to create a map faster and more efficiently, as well as on ways to move topics, navigate them, how to publish a map, or modify it into a presentation. Participants will be given a deadline (two weeks) to design and create a mental map at home for at least one of their lectures in one of the available web tools.

Snowball Method

The snowball method is actually a teaching strategy through which students writes on paper discussion topics (opinions, questions, etc.) related to a topic or a concept that is being analyzed and seen as a problematic one. The purpose of this methodical procedure is to encourage discussion or help to better understand the content being learned. In fact, students teach each other about important concepts and share information about them. So, students are divided into groups. For example, in the first phase, they can start working on the concept on their own, and then work with a partner from the group that usually consists of 4 participants. After that, group of 4 members merges with another group of 4 members and form a group of 8 members and supplement their concepts. This continues until everyone in the class, i.e., the whole group, works together as one large group. It is important to note that there are many variations of group work. One of them is when students are asked to work independently, then with a partner, and then in a group of 4 members. This is where the formation of further groups stops and a discussion on a given topic begins. Another variation is to assign students to

a group of 4 to 5 members that would make up an expert group. They are asked to discuss or talk about one part of the task. After a certain time assigned expires, they return to their primary groups. The primary group should consist of one student who belonged to the expert group. Expert group students exchange information with the primary group members. Therefore, each member is responsible for teaching one piece of information (task) to the primary group. Another potential variation is, as already mentioned through several steps or stages, for the group leaders to present materials to the primary groups. Moreover, each participant is given a worksheet in which they write down all the questions related to the material previously presented and explained by the group leader. The paper is finally crumpled into a ball and thrown from one student to another for approximately five minutes. Students who receive the paper ball containing questions are given the opportunity to alternately answer questions written on paper, which continues with the evaluation. In this way, both the teacher and students have an active role and learn through fun. Students are trained to willingly share knowledge with each other.

A distinct advantage of this approach to learning is effective communication the classroom. It is clear that cooperative learning is encouraged because students work and learn together in groups in order to complete tasks and achieve expected goals. As this is not just a collaboration process, the teacher should prepare the lesson properly, to adequately plan each phase and guide students. The snowball teaching technique enables learning through fun situations and activities, and the motivation to learn is additionally strengthened in such an atmosphere, because learning in this way avoids the feeling of depression. In addition to the above stated benefits, Manurung and associates (Manurung *et al.*, 2019) indicate that in such conditions it is possible to also further improve creative thinking skills because motivation is a good foundation and support for turning oneself into a creative thinker while improving reasoning skills. Therefore, this game which resembles snowball game, from the first ball onwards, challenges and provokes creativity in a certain way by asking questions while at the same time testing of the absorptive capacity of the material presented by the group leader. Through this type of game, students are actually relaxed, but still controlled and not too noisy, confused or "problematic". The mathematical learning material that is presented to students must be constantly analyzed, and reconsidered more frequently in order to obtain a more detailed and integrated knowledge structure that would be used to transfer new tasks that actually differ from those presented in the lesson.

Apendix 3. Scenario of training activities – Implementation of snowball method in mastering math contents

Project	Strengthening Teacher Competencies in Higher Education in Natural and Mathematical Sciences
Training	Teaching methods in university settings: How to teach students how to learn
Topic:	**Snowball method in math teaching**

Contents:	- Snowball method as a learning method through play and teaching technique aimed at active involvement of students in the process of teaching and learning through collaborative work; - Graduation of knowledge - snowball by snowball of knowledge - from individual giving answers and exchanging ideas in pairs through progressive creation of larger conversation groups through gradual doubling of their size to a large discussion groups at the end of the activity; - Organization, nature and flow of snowballing in teaching process: "ice breaking", collaborative work on materials, learning through fun and play, engagement; - The role of "snowballing" in math teaching with special attention to the development of mathematical expression and enrichment of mathematical vocabulary.
Aims of training:	- acquainting the essential features of snowballing in teaching, its advantages and disadvantages; - knowing and understanding the nature, organization and flow of "balling" technique in math teaching; - mastering the technique of snowbaling in teaching mathematical content; - assessment and organization of snowballing in natural and mathematical sciences; - guiding the flow of communication in the implementation of the snowballing method; - thinking and considering about the possibilities for upgrading lectures on the basis of acquired knowledge; - researching and analysing of the benefits of electronic tools for quality organization and realization of snowballing in the online environment.
Training outcomes:	Participants are expected to be able to: - recognize the features of "snowball" in teaching, identify the advantages and highlight the disadvantages; - understand how to apply the snowball method; - organize snowballing and guide the flow of communication between participants; - practice the application of the snowball technique on appropriate mathematical contents; - independently design and implement a snowballing in initiating student participation and motivation in solving mathematical problems; - improve their own mathematical units on the basis of acquired knowledge; - analyze the benefits of electronic tools for adequate implementation of snowball method in an online environment.
Form of work	Frontal, Individual, Work in pairs, Group work
Teaching methods	Oral presentation method, Demonstration method, Conversation method

Teaching tools	Papers, photos, pptx presentation, working materials, laptop, projector…
	Teaching materials:
	- Manurung, N., Samosir, K., Hia, Y. & Mariani, M. (2019). Implementation of Snowball Throwing Type of Cooperative Learning in Calculus Course.*International Education Studies*, 12(3), pp. 124-134. https://doi.org/10.5539/ies.v12n3p124
	- Mrayyan, S. (2016). Teaching Methods for Developments of Mathematic Teaching of Math, and Methods Teaching Mathematics College Students. *American Journal of Educational Research*, 4(2), pp. 147-149. doi: 10.12691/education-4-2-1
	- Novi, M. (2016). Implementation of Learning Snowball Throwing Method to Improve Student Learning Outcomes of Operation Management Subject. In H. Cahyono, A.F. Prakoso & R.P. Poetra (Eds.), *Economic Education and Enterpreneurship*. Indonesia: Faculty of Economic Universitas Negeri Surabaya.
	- Suzić, N. (2005). *Pedagogija za XXI vijek* [*Pedagogy for XXI century*]. Banja Luka: TT Centar.
	- Vijayabarathi, S., Pramila, K. & Sengamalasevi, J. (2013). Teaching Mathematic with Inovative Methods.*International Journal of Computing Algorithm*, Vol. 2, pp. 299-304.
	- Vilotijević, M. (1999). *Didaktika – organizacija nastave* [*Didactics – Organization of Teaching*]. Beograd: Učiteljski fakultet.

Training design	Through this training, to participants will be given the opportunities to get acquainted with one of the active learning strategies, which as an helping tool gives students the opportunity not only to exchange their views and knowledge on various topics and concepts, but also to learn from each other. In addition to introducing the nature, structure, organization and flow of implementation of this teaching method in the teaching and learning process, the training also includes a demonstration of some ways to implement it, so that trainees are active participants in the imaginary teaching situation in which this method is applied. The intention is that through careful planning and guiding the flow of this teaching strategy, the participants experience and feel the benefits of "snowballing" in math teaching, i.e. that through this method they are guided towards the knowledge production and the development of collective thinking. By practicing this methodical procedure, the participants get a clear idea that the essence is not who wrote what, but the essence is contained in new perspectives that arise or are just beginning on the basis of what others have written on a given topic. Among other things, and in accordance with the current epidemiological situation, the training includes reflection on the benefits provided by modern electronic tools in the implementation of this methodical procedure in the online environment.
Topic	**Snowball method in math teaching**

Content overview	- Snowball method as a learning method through play and teaching technique aimed at active involvement of students in the process of teaching and learning through collaborative work; - Graduation of knowledge - snowball by snowball of knowledge - from individual giving answers and exchanging ideas in pairs through progressive creation of larger conversation groups through gradual doubling of their size to a large discussion groups at the end of the activity; - Organization, nature and flow of snowballing in teaching process: "ice breaking", collaborative work on materials, learning through fun and play, engagement; - The role of "snowballing" in math teaching with special attention to the development of mathematical expression and enrichment of mathematical vocabulary.
Activity plan	(total duration about 105 minutes)
Introductory activities: **25 minutes**	The introductory part should lead the participants to think about the snowball method and their first associations that are related to this methodical procedure in the teaching process. Participants are introduced to the topic through a heuristic conversation, that is, by asking questions of a developmental nature: Is the snowball method a procedure that we can use every day in teaching mathematics? What is the snowball method? What are the first associations related with it? In which situations could it be applied more frequently? After thoughtful participants guiding, the educator suggests on the essence of this methodical procedure. Through a short introductory presentation, educator introduces the participants to the nature, organization and flow of this methodical technique as well as different strategic procedures of snowballing for different purposes in teaching (as an introductory activity, "ice breaking", cooperative learning, developmental discussions…). By referring to different ways of organizing snowballing (in pairs, in small groups, large groups, circularly), the educator uses the opportunities to point out to the advantages and disadvantages of this methodical procedure. In order to demonstrate the simplest snowballing, the educator starts with a short activity, i.e. informs the participants about the material that will be studied and assigns the task "Guess who am I". Participants are asked to stand up and the educator plays music on the laptop. As soon as the song begins, the educator throws a crumpled sheet of paper in the shape of a ball to the first participant. The first participant throws the ball to the second from right to left and so on in a circle as long as the music lasts. The educator stops the music at some time. A participant who holding the ball at the moment when song ends should answer what the educator asked and shows (informative sentences and part of the picture of one of the famous chemists). If the participant cannot answer correctly, the game continues until one of the participants answers correctly (participants can ask the educator short sub-questions and note the answers) and in case none of them answers correctly, the teacher will give an answer about the enigmatic person. In this way, participants are placed in a situation not only to cope and participate in three activities at the same time (watching, listening and speaking), but also to learn, memorize and think through fun and in some relaxed atmosphere. Educator uses once again the opportunity to introduce the participants to different

	ways of organizing snowballing through a power point presentation, as well as to point out its role in teaching mathematics.
Central activities: **60 minutes**	*First part (30 minutes):* After the presentation, the educator forms smaller groups of 4-6 participants for snowballing fight who will sit in a circle to more easily establish a natural interaction. After that, the educator assigns the task to the group, that is, starts the topic of "Sisyphus' work". Each member of the group will be given a piece of paper on which they need to write down their first thoughts about the assigned task, that can be expressed in the form of questions but clear and precise enough in a few words so that others can understand what the person thinks when they read them. For this activity, the educator gives the participants approximately 5 minutes to write their thoughts on the given topic. After the allotted time, each participant crumples his paper in the shape of a ball and throws it towards the person in front of him or simply gives his/her paper to the person on the right. The people who received the paper read what was written and write down their thoughts and comments. Their comments can fill in information, deny or question what their precursor wrote. The idea is to continue developing ideas and thoughts. When all members of the group have written comments, the papers are reassigned to the person on the right, and so on until each participant receives the original paper from which he/she began his/her first thoughts. If the educator assesses that the goal has been achieved, this exercise can be stopped before the paper goes around the whole circle (or if the groups are of different sizes). After this activity, participants are expected to summarize their impressions and share their dilemmas and thoughts with the educator. *Second part (30 minutes):* According to the already formed groups, from the participants are expected to jointly design a specific organization of teaching work on mathematical contents by applying the snowball method with exploring other modalities (for example, organizations through expert groups and main groups, collaborative learning through developmental questions and answers with group leaders...).
Ending activities: **20 minutes**	In accordance with the designed organization of the math lectures through balling, each of the groups presents their works to other groups, thus demonstrating the acquired knowledge and skills during the training. Having in mind actual corona epidemiological situation and current practice of online teaching, at the same time, the educator uses the opportunity to assign participants tasks for work at home. This tasks imply that they need to transfer results of group work to the online environment and take advantage of various electronic tools. For this activity, the educator gives the participants 2-3 weeks, after which the educator evaluates done.

Flipped Classroom Method

The flipped classroom method can be understood as a teaching model that was unknown in academic circles until only a few years ago, and by its very appearance it caused considerable attention, gained numerous supporters and fans among university teachers and not only among teachers at lower education levels. According to Fernandez-Martin and associates (Fernandez-Martin *et al.*, 2020), it is one of the most popular methods at the higher education level, characterized by the application of face-to-face teaching and virtual teaching through video recordings and online materials, which otherwise promotes autonomous, flexible and more dynamic teaching for students. The application of this methodical procedure is based on direct teaching that takes place outside the educational group, i.e., the standard teaching environment for group learning (amphitheater, classroom, laboratory…) and by using pre-prepared video lectures by teachers or other modalities. Students can access the video lecture from home and thus get acquainted in advance with the contents that are crucial for the lesson.

Therefore, the lesson planned for lectures is then used to engage students in practical learning. Through collaborative activities, students approach to problem solving based on knowledge acquired through videos, collaborate with each other and exchange opinions, and assess their progress, which is a significant benefit compared to traditional teaching. In this case, teachers are facilitators, people who can at any time provide individual assistance to each student, certain guidelines but also inspiration for the planned activities. From the very essence of this method, an easy transition from teacher-oriented teaching to a student-oriented learning environment is obvious.

There are numerous reasons why the flipped classroom method is suitable for the higher education environment. Detailed discussion within the learning group and fairly improved activities ensure the delivery of learning content outside of class time, which certainly provides students with the opportunity to develop crucial skills necessary in the 21st century, such as critical thinking, creativity, communication and collaboration. Another reason why this method is desirable is that through this model it is easier to organize and present the course contents attended by large groups of students, where it is quite common for students not to participate enough in lessons organized in a traditional, conventional way.

When students receive a lecture in advance, they can actually use the time in class more effectively for productive group discussions with their colleagues or to engage in some other planned classroom activities. Teachers themselves use their time more efficiently by monitoring and reviewing content which students found difficult and which they need help with, provide additional instruction or a certain input. Teacher is the one who guides them through the discussion where the need for that arises. This type of learning very much enables differentiated learning of any type, taking into account the fact that students can watch the video at their own pace, and ask questions at a time that suits them. It can be noted that there are numerous studies which indicate that learning by applying this methodical procedure intensifies group work towards higher levels of Bloom's taxonomy, such as analysis that requires more discussion, making the face-to-face lesson more valuable and profitable. The impact of this method on performance and motivation in the field of mathematics is obvious, it improves student's progress through content that is difficult to assimilate, but also enhances the work environment and students' attitudes towards the subject and the content being processed.

The flipped classroom method can be understood as a kind of pedagogical and andragogical approach that consists of two key parts: (1) direct computer-based individual learning outside the classroom, and (2) interactive group action and learning in the classroom. For example, educational videos delivered to students should be designed and presented in a conversational style, and the topic of the video should be divided into a series of shorter segments to support students in managing cognitive load. For efficiency and effectiveness purposes, videos should not be longer than 6 minutes, which is consistent with the average time assumed to be sufficient for full engagement and holding students' attention while watching the video.

As mentioned above, dividing the topic into shorter sessions is more than desirable, as is the teacher's presentation in accordance with this division. If the clips are longer than recommended, it is recommended for the teacher to add certain tasks between key sessions and parts: questions about the reviewed content (direct questions, problem-based questions...), adding a set of notes and observations about the content that is being taught, additional explanation and so on, thus in fact, throughout this process, they direct the various activities that take turns and in which students work outside of class, and check their readiness for class. For the purposes of assessment and self-assessment, a knowledge quiz can also be introduced, which is now possible with many simple software management tools (EdPuzle, Aunt ...). Students can always return to the video lesson if they have not answered some of the set tasks or questions and the teacher is constantly monitoring their progress.

Based on the results of the online quiz or knowledge test or student notes, teachers get feedback on learning outcomes outside of classroom, and based on this they design their lectures in the classroom. If students have not completed the planned tasks, the teacher can encourage them to complete them during the break or after the lecture. Solving simple problem situations related to the video can be a good basis for the introduction or the very beginning of the lecture in the classroom setting. Teachers can use the opportunity to clarify the parts with which students had difficulties or did not quite understand them, but also give a brief overview of the content presented outside the lesson. Class activities should be of better quality and greatly improved with the results of learning outside the classroom, and problem solving in the flipped classroom takes place in groups.

In mathematics lessons, in order to achieve productive discussion and full engagement of students, teachers can ask questions that require more detailed and deeper reflection, a high level of mental engagement of students, and can include complex and intellectually demanding knowledge that students can answer in different ways. Certainly, the time spent in the classroom itself should be used by teachers to monitor the learning that takes place and to circulate among the groups. In this way, intergroup discussion, detailed explanation of procedures and confirmation of assumptions for solving set problem situations can be encouraged.

The reverse classroom as a hybrid model encompasses three lines of learning, to which Fernandez-Martin and associates (Fernandez-Martin *et al*., 2020) draw attention: (1) individual learning, which is adapted to the different learning rhythms, since the contents of the first phase can be visualized as often as necessary, and it encourages responsible and autonomous work; (2) collaborative learning, worked on during the second phase, where in groups pursue objectives that are agreed upon until the final objective is reached; and (3) problem-based learning, which also takes place in the second part of this teaching method, in which what is learned is put into practice in a contextualized way,

enriched by the contributions of the group's colleagues, and it is checked whether the learning has been effective.

The advantages of implementing the flipped classroom method in teaching tertiary level mathematics are numerous. Some of them are: (1) encouraging higher levels of Bloom's taxonomy, i.e., higher-level thinking, such as analysis, (2) positive impact on student performance and increase in motivation to master mathematics content, (3) pleasant learning environment, (4) minimization of traditional learning routines, (5) developmental methodical basis, (6) interactivity of applied methodical techniques and procedures. Of course, this method is not without its flaws, which are mainly related to: (1) digital division of students, (2) technical equipment requirements (computer, smart devices, Internet), (3) technical challenges and difficulties in creating and viewing videos, (4) more time spent at computers.

Apendix 4. Scenario of training activities – Acquisition of mathematical contents using the inverse classroom method

Project	Strengthening Teacher Competencies in Higher Education in Natural and Mathematical Sciences
Training	Teaching methods in university settings: How to teach students how to learn
Topic:	**Flipped classroom method and Mapping method**
Contents:	- Inverted (flipped) classroom model (features, types and organization); - Principles of application of the inverted classroom method; - Mastering the basic technological tools for the preparation of teaching materials for the effective application of the reverse classroom method; - Mental mapping and summarizing content in the process of reversing classroom; - Requirements for guiding students through lectures organized using the inverted classroom; - Significance of the initial and final assessment in the content mastering.
Aims of training:	- Understanding the essential features, types of inverted classroom and the principles of application of the reverse classroom method; - Creation of lectures by using available platforms, educational software and tools; - Applying of mental mapping and techniques of summarizing; - Mastering the skills of guiding students through individual and group work; - Knowing the possibilities of pre-assessment and assessment of student work and creating a plan of new activities in lectures based on the assessment; - Integrating ways to connect content from different subjects nad areas.
Training outcomes:	After training completion, it is expected from participant to be able to: - Understands the essential features of the inverted classroom, rules and principles of materials organization and preparation, scope and limitations of the application of the inverted classroom method; - Use mental mapping and summarizing techniques in the presentation of works; - Demonstrate effective guidance in the process of individual and group work with students;

	- Modify and explore the possibilities of designing their own lectures using available platforms, multimedia content, educational applications and software. - Design and create an action plan for the lecturing of mathematical content using the reverse classroom method; - Select and apply suitable methods of evaluation in the initial and final stage of work through the method of inverted classroom and on the basis of pre-assessment anticipate new activities; - Correlate contents from other subjects or areas.
Form of work	Frontal, Group, Individual
Teaching methods	Demonstration method, Method of oral presentation (describing, explaining...), Conversation method, Mental maping method, Brainstorming...
Teaching tools	IdeaBoardz (or Flipchart), video lecture, paper, sticky notes, PPT presentation, laptop, projector, lesson plan template *Teaching materials:* - Cevikbas, M. & Kaiser, G. (2020). Flipped classroom as a reform-oriented approach to teaching mathematics. *ZDM Mathematics Education* 52, pp. 1291–1305. https://doi.org/10.1007/s11858-020-01191-5 - Fernández-Martín, Francisco-Domingo; Romero-Rodríguez, José-María; Gómez-García, Gerardo; Ramos Navas-Parejo, Magdalena (2020). Impact of the Flipped Classroom Method in the Mathematical Area: A Systematic Review. *Mathematics* 8, no. 12: 2162. https://doi.org/10.3390/math8122162 - Lo, C.K, Hew, F.K. & Chen, G. (2017). Toward a set of design pronciples for mathematics flipped classroom: A synthesis of research in mathematic education. *Educational Research Review*, Vol. 22, pp.50-73. - Hamden, N. et al. (2013). A Review of Flipped Learning www.flippedlearning.org https://www.edutopia.org/article/4-tools-flipped-classroom https://teachingcommons.unt.edu/teaching-essentials/teaching-technology/planning-flipped-lesson-step-step-guide https://www.youtube.com/watch?v=oWJ-j2RLKEo https://www.youtube.com/watch?v=liW_ALj4Qj8&t=36s

Training design	The training is aimed toward understanding the idea of a flipped classroom, i.e. a pedagogical model and methodical act in which the usual elements of lectures, homework or pre-exam obligations are implemented at the reverse level - short video lectures are placed according to the targeted population before the scheduled class, while on class more time is invested in practical activities, discussions or designing smaller projects. Also, the training includes the use of some of the available platforms and mastering certain educational tools suitable for the successful preparation of the necessary teaching materials. Adoption and application of this methodical procedure provides a good basis for teachers to achieve adequate engagement of their users of educational services, but also to gain a clearer picture about the heterogeneity of groups that they work with, difficulties and obstacles they face, as well as different ways of solving mathematical problems and learning styles.

Topic	Flipped classroom method
Content overview	- Inverted (flipped) classroom model (features, types and organization); - Principles of application of the inverted classroom method; - Mastering the basic technological tools for the preparation of teaching materials for the effective application of the reverse classroom method; - Mental mapping and summarizing content in the process of reversing classroom; - Requirements for guiding students through lectures organized using the inverted classroom; - Significance of the initial and final assessment in the content mastering.
Activity plan	(total duration 140 minutes)
Introductory activities: **20 minutes**	The educator starts with a self-made video lecture - *Flipping Math - Find the Solution*. The video contains segmented tasks presented and recorded in the form of a screen cast as material prepared for first grade elementary school learners. The aim of this video is to introduce the participants to the first steps of preparing materials for the reverse classroom and the possibilities for their placement on different platforms that we use in distance learning. After the lecture, a heuristic conversation and discussion about the material will be conducted with the participants. The main aim is to point out on the basic features of the inverted classroom method through mental guidance, to single out the basic principles that should be adhered to in its application. Also, based on the given video, the participants are asked to conclude which educational tools the educator used to prepare this material.
Central activities: **100 minutes**	*First part* (30 minutes): After highlighting the key steps in the organization and implementation of the methodical procedure of the inverted classroom, the educator using available teaching tools (video beam and laptop) or by forwarding a link to participants shows examples of classes in which this methodical procedure was applied (two examples will be presented to participants - mathematics and chemistry/or physics). This way contributes to a deeper understanding of the inverted classroom, but also to a detailed consideration of examples of the application of this methodical procedure. After reviewing the examples, participants are divided into groups and based on what they saw they try to present stages and key elements of each of them by mental mapping, the activities that they identified and that are important for the adequate implementation of this pedagogical model. *Second part* (20 minutes): After completing this task, every group presents their maps to other groups, with brief explanations and summarization. During the presentation of the groups, the educator directs with the sub-questions, emphasizes the most important ones and shows self-made online mind map. Thus, in addition to the inverted classroom method, participants gain insight into the method of mental mapping and extraction of key concepts. *Third part* (30 minutes): In order to introduce participants to the importance of initial and final assessment of material mastering (pre-evaluation and post-evaluation), educator shows participants how to create a knowledge quiz in Socrative

	and Mantimeter applications that users can access from any electronic device they have (laptop, desktop, mobile phone, tablet), and also points out on the possibilities to set tasks in the written form in Google classroom and on recording in the Padlet application by leaving a sticker note with recorded answers on the wall, so the teacher can access to recordings at any time and check the level of mastery. With this way, it is emphasized that the teacher before coming to class actually has an insight into the level of student progress through pre-evaluation, which actually draws the attention to another important phase of work in class - forming groups of students at lower, middle and higher levels. Students with medium and high levels of content mastering will be given tasks on which they will work in groups (tasks of higher levels of complexity and medium level of complexity), while students from the first category need individual work and support to clarify the gaps that the teacher has already seen in the pre-evaluation phase. After this phase, a final evaluation will be performed according to the teacher's choice, in the same way as the pre-evaluation or in another way, so he/she could compare the results and progress of the students. Through a short PPTX presentation, the educator debriefs the work done and especially draws the participants' attention to the need for clear and precise guidance of students through both, individual and group work, as well as respecting the basic requirements of the reverse classroom method.
Ending activities: **20 minutes**	Participants will be asked to set the sticky note on the board named *Pros & Cons* (or online board) so they could answer the questions: why would they apply this methodical procedure (pros) and why not (cons)? In the final stage of the training, from the participants is expected to apply the acquired knowledge and skills by starting to create a detailed plan of activities for a teaching unit that they teach in a template assigned to them by the educator. The educator informs teachers about other useful software and applications that can be used in creating video materials, knowledge tests and other teaching materials necessary for efficient and effective implementation of the reverse classroom model, which are not mentioned during the presentation. The participants should finish the started activity at home for a certain period of time and create the teaching materials necessary for the realization of the lecture through the reverse classroom.

Apendix 4.1. Flipped classroom lesson plan - template

Teaching unit:	
Teaching subject:	
Teacher name and surname	
Date:	

Learning objectives (briefly list them according to Blooms taxonomy)
Expected learning outcomes

Home working resources (list all resources or add accompanying links)
Student activities at home (briefly describe the requirements / tasks that the participants need to realize and add links to them)
Classroom activities (clearly indicate the time articulation of all activities and describe each in a few sentences)
Assessment (explain the ways of assessing mastering content and how they are implemented) *Diagnostic assessment:*   *Formative assessment:*   *Summative assessment:*

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web resources:

https://www.edutopia.org/article/4-tools-flipped-classroom

https://teachingcommons.unt.edu/teaching-essentials/teaching-technology/planning-flipped-lesson-step-step-guide

https://www.youtube.com/watch?v=oWJ-j2RLKEo

https://www.youtube.com/watch?v=liW_ALj4Qj8&t=36s

* Note: literature consists of references that were used as theoretical background for the text and for the preparation of training materials and accompanying presentations.

Author:
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Questions:

Constructivism as a framework for understanding inclusion.

The concept of disability through a historical, social, economic and educational perspective.

The role of education in reducing the social exclusion of people with disabilities.

How to adapt access to students with disabilities in higher education?

Difficulties and challenges of inclusion in higher education

Contents

Introduction: Social Constructionism and disability

1.Vygotsky's cultural-historical theory
2. Basic principles of Constructivism in Psychology
3. Disability

The basis of the philosophy and inclusion paradigm is the development of respect for differences recognizing the development and the diversity of the human race. Individual existence is formed only by the encounter with others.

The hold points of constructionist metatheory - relativism, relationalism, participativism and potentialism speak of a new understanding of the development of knowledge, personality and relationships between people, as well as views on diversity and limitations and handicaps.

Relativism (which opposes realism) implies the idea of the existence of many different frameworks of reference and the study of the consequences of different perspectives.

Relationalism (which opposes essentialism) believes that psychological properties have arisen from the activities of people and their relationship with others.

Participativism (as opposed to objectivism) says that psychological categories are constitutive views of the world where a person who learns about that world is included.

Potentialism (as opposed to actualism) implies that in constructionism the emphasis is on processes, not on structures, and phenomena are studied in their continuous development, emergence and change.

Residual notions" regarding science constructionists are replacing with a new paradigm, which presents new principles and requirements for researchers:

research cannot be conducted in isolated laboratory conditions, but in the everyday world of joint human action;

during research, utmost attention must be given to the role of language and discourse, as a construction of a problem or communication between people; - research and life are viewed as something that is procedural, i.e as a set of dynamic interactions;

research should imply an interest for individuals.

Social constructionism (Ber, 2006; Stojnov, 2005) analyzes the role of social processes in the construction of meaning; knowledge is positioned among people and emerges from social exchange -

language-mediated communication. In a world of many communities, cultures and languages, there are many different realities - we live in a multiverse (Maturana, according to Ber, 2006).

The task of science is to increase tolerance for the growing uncertainty caused by the different and inconsistent perspectives that people shape through their exchanges. The task of psychology, as seen by social constructionists, is to examine the implications of numerous parallel orders that have enormous cultural specificities, different communities of people in the multiverse, but also to take responsibility for their construction and change.

Basic psychological concepts emerge as culture-dependent social constructions in the context of specific social circumstances. Psychology's field of study implicates socially constructed beings as products of historical and culturally specific discourses, bringing a complex network of relations (power). The concept of objective reality is relativized in favor of a personal perspective and emphasizes the activity of a person - the cognizer in the process of creating their image of the world and the way they form relationships with other people.

In Constructionism, the terms "I", "Self", "human nature", "personality" originated as interpretations of a certain reference system and are conditioned by the observer's point of view. Humanity exists only as an opportunity that must be earned - by entering into social relations with other beings who have already realized themselves as persons.

Humanity must be mastered, that is, constructed through communication with others. Being a person means not only having tolerance, but love for differences. "With tolerance we are alone, and with love we are together" (Schaeffer, 2003, p. 10). From an evolutionary point of view, differences are the essence of the survival of the living world. From the position of human development, differences encourage ideas, creativity, and opportunities to overcome challenges. From the aspect of cognition, differences stimulate curiosity and divergence of ideas. Differences enable the formation of individuality.

The paradigm of inclusion is based on the idea of dynamic interactions of united action of people, interest in each individual and their existence, respect and love for diversity - the right to diversity and the diversity of rights. A truly democratic society must enable all its members to form a personal perspective, to give them an opportunity to participate in development, emergence and change, and the existence of differences as wealth and potential. In the field of education, social constructionism starts from the premise that the mental activity of a child cannot be separated from the social and cultural context and that the learning process takes place with respect for the social and physical context (Vigotski, 1996 10 –b, Piaget, 1977).

Constructionism in the sense of pedagogical-psychological practice starts from the thesis that learning is a process of active construction of knowledge, where educational practice is focused on the student. The emphasis is on the process itself, not on the products of learning. Educational activity has a flexible structure, the essence of the learning process is mutual intra and intergenerational communication.

The social-constructionist perspective offers principles as a basis for implementing the practice of inclusive education:

the concept of the inclusive classroom as a learning community, which implies different but fair opportunities for active participation;

socially mediated learning, mutual contribution of teachers and students to the acquisition of competencies through the process of guided participation;

culturally relevant and problem-based curricula, teaching materials, activities, rules and teaching strategies enable multidirectional communication in order to achieve common learning goals;

authentic assessment through learning-motivating feedback; assessment should be emotionally supportive and integrated into meaningful learning experiences (Milutinović, Zuković, Lungulov, 2011).

Social constructionism emphasizes the importance of social context in the construction of knowledge. While respecting diversity, it provides strong support for inclusion in education. The pedagogical process is not purely intellectual, but it is also effective, based on effects, empathy, altruism. Reasons and needs for respect towards each individual (child), for love of diversity and inclusion, will be much closer to everyone participating in inclusion, if the acceptance of diversity is less rational, and more felt and experienced through authentic encounter and communication of one person with another and mutual construction of their perspectives.

Cultural-historical theory of L.S. Vygotsky

In his preface to Vygotsky's work "Opinion and Speech", Ivić points out that "Vygotsky offered such solutions to the basic dilemmas of psychological science, which are still not sufficiently used in the theory or practice of psychological research, and therefore represent a good theoretical framework (even) for contemporary problems in psychology." (Vygotsky, 1983, p. 25). The understanding of the social nature of disability, the primary and secondary consequences of developmental disabilities, the inclusion of children with developmental disabilities in regular life flows, have their source in Vygotsky's theoretical system. In the thirties of the last century, Vygotsky (1983, 1990, 1996, 1996-b, 1996-c) elaborated the basics of the cultural-historical theory of the development of the psyche. According to him, the nature and structure of mental functions tend to change throughout history; psychology should be based on the science of historical changes in the psyche and behavior. Vygotsky provides a basis for understanding the way in which culture - values, beliefs, customs, are passed from generation to generation. Social interaction - communication, plays a key role in overall mental development.

Vygotsky emphasized the role of the social environment - in addition to personal, there is historical and social experience important for every man (collective coordination of behavior), within which self-awareness arises - man is a social being above all. The social environment is the source of the historical development of human behavior. According to Vygotsky, more and more mental functions are of social origin: opinion, speech, emotions, voluntary attention. The general genetic law of cultural development reads: "through others we become what we are " and "to say that a process is external means that it is social, each function in the child's cultural development appears twice - first socially and then psychologically. - first in social interaction as an intrapsychic category, and then within the child itself as an intrapsychic category"(Vygotsky, 1996. p. 114).

This understanding of Vygotsky is one of the forerunners of social constructionism (Stojnov, 2005). The understanding of Vygotsky's sociogenesis of higher psychic functions and the process of internalization is seen as a significant contribution to the social construction of the mind. The significance of Vygotsky's theory lies in the analysis of the concept of the Zone of next development. According to it, the role of an adult is to recognize a sensitive period in the child's functional

development, when the child is one step away from structural change. Adults should have a timely stimulating effect on the child's development by recognizing the period and range of the Zone of next development.

The orientation of teaching is aimed not towards the ability of mental development that the child has already adopted, but on the ability of the properties of the mind that is still being realized. Teaching can (and should) go ahead of development, move it further and encourage and provoke new educational needs in the child. Pedagogy should not be oriented to yesterday's, but to tomorrow's level of the child's development. Training - teaching is the driving force of mental development, it creates a Zone of next development that encourages, awakens and leads to an internal process of development in cooperation with adults and peers. Learning "pulls" development if we operate in the Next development zone. ***It is necessary to create increased difficulties for the student, since the opinion always arises from difficulties.***

This concept gains even more importance in working with students with developmental disabilities and their preserved potentials. Vygotsky emphasizes that there is essentially no difference between normal and disabled children - both are human, and both are - children, the development of both took place according to the same laws. The only difference is in the way they developed. A child who has a disability is primarily a child with all the specific needs any other child has, but they satisfy their needs in a different way, indirectly, by different means. Here we encounter dialectic - a handicap is both a child's weakness and strength - a weakness that leads to the power of overcoming - a handicap compensation through efforts to satisfy one's (human, children's) needs by detours.

Handicap changes a person's attitude towards the world and is first manifested in interpersonal relationships. Physical deficiency causes a disorder of social forms of behavior; a child with a disability has different experiences with social environment, which shapes their personality. The characteristics of a child with a disability are not based on a biological, but a social core. The defect leads to deviations from the typical biological development of a child and necessarily conditions the reorganization of the entire development on new grounds, which disrupts the normal course of the process of a child's integration into society. A child with a disability, according to Vygotsky (1996), is not handicapped. However, they will become handicapped only when the secondary consequences of disability due to the changed attitude of society towards them are manifested. The child's psyche is not formed primarily under the influence of a physical defect, but secondarily under the influence of social consequences caused by that deficiency.

We often cannot have any or can have very little effect on the primary consequences of a handicap, so the field of action on the secondary consequences of a handicap is wide, if adults - parents, professionals, know how to recognize it. Handicap leads to a different social position, as if creating a "social dislocation" analogous to the physical.

Raising a child with a disability means helping them adapt to social life. The educational task consists in including a child with a disability in everyday life and in order to compensate for their lack - the disturbance of the relationship with the society should be regulated according to the child's (preserved) abilities. All activities undertaken must be stimulated by a child's needs and enriched with the meaning of life; the goal is to educate the child to live in society.

Society is the final and decisive factor in the educational system. School appears as an instrument of social education, while work, society and nature are the basic trajectory of educational work in schools. Vygotsky (1996) believes that the special school is antisocial and that it encourages antisocial behavior. The special school captures the child in a narrow circle of school staff, creates a separate world in which everything is adjusted to their handicap - thus leading to even greater isolation and intensifying the child's separatism. Children with disabilities do not need an extended stay in school, nor learning in a class with a smaller number of pupils, nor a class with children who have a similar handicap. They need a school that will bring them closer to life. Of course, it is necessary to design "special cultural tools", adapted to the mental structure of every disabled child.

The classical school, according to Vygotsky, emphasizes the stillness and staticity imposed by plans and programs, the subject-class-hour system, traditional methods and procedures. An active school, however, should provide each child with progress in accordance with their own abilities, through communication and encouraging development by acting in the Zone of next development. The role of the teacher is to provide new and unknown content and conditions that enable students to reach higher levels of understanding.

Unlike the traditional approach that emphasized deficits, weaknesses and shortcomings, the historical turn implies the focus on strengths, i.e., qualities, potentials and opportunities in the individual, family, community, in order to achieve a better and happier life, present in the system orientation, whose basics were defined by Bertalanffy (1937). The principles on which the systems approach is based are:

better connectivity within the system, which implies more efficient functioning of the system as a whole;

changes in one part of the system are reflected in the system as a whole;

if the system is steadily organized, the subsystems within it are better connected, and vice versa;

the environment surrounding the system affects the efficiency of the system itself;

harmonization of subsystems and their complementarity enable more efficient functioning of the system in order to achieve a common goal.

Poverty and disability are cyclically linked. People with disabilities usually do not have access to economic and educational resources and live in degraded conditions - when it comes to health care, nutrition, hygiene, communication. Due to the specifics of development and existence, people with disabilities have additional barriers to accessing their rights, with unequal and discriminatory treatment / typical population has additional costs for the use of goods and services. This often makes them "invisible people". The promotion of people with disabilities is possible only by changing the paradigm - from a medical model of developmental disabilities, to a social model of developmental disabilities based on respect for human rights; from welfare based on social protection, to welfare based on social inclusion.

Basic principles of constructivism in psychology

The first attempt to define constructivism in psychology, as well as the systematization of various constructivist directions into constructivist metatheory, was made by Michael Mahoney (Mahoney, 1988, according to Stojnov, 2001). As the basic characteristics of constructivist metatheory, he states:

1. proactive cognition

2. morphogenic structure of the nucleus and

3. self-organizing process of development.

Proactivity, i.e., an approach to human knowledge, emphasizes its active, anticipatory and 'constructive' nature (in terms of the ability to shape). Most non-constructivist theories attribute a passive-reactive, receptive, and 'retentive' role to mentation and the human mind (in terms of storage capacity). On the other hand, constructivist theories under mentation imply the activity and generativeness of a complete, embodied and social subject. Their goal is not to reduce the activity of the mind to the ability to store data about the inherent properties of things — copies of reality or bits of information — that grow into a structure. For constructivists, storage is not solely the internalization of finished data, but the active process of their creation, maintenance and elaboration: information is not transmitted from the environment to the body through the senses, but, in accordance with the etymological meaning of the word (in formare), they represent something that shapes from within. Therefore, in their opinion, the object of cognition is not a transcendent, but a constitutive reality (Maturana & Varela, 1980, according to Stojnov, 2001). While the first implies the existence of a world that is independent of our efforts to determine its characteristics, the second implies a cognizer who, by establishing the characteristics of entities, attributes the property of existence to those entities. The characteristics that are established are not the inherent properties of the world, but our anticipations or fictions, that is, the constructs of our mind. That is why von Foerster (1981, according to Stojnov 2001) considers constructivist thought's subject of study to be the ontology of the observer, that is, the observation of observation, and Kelly (Kelly, 1955, according to Stojnov 2001) the construction of the process of construction.

Another characteristic is the morphogenic structure of the nucleus. "Morphogenic" literally means "shape creation". Humans are structured so that their central, core, or nuclear processes dictate and limit forms expressed at surface levels. The constructs that form the core structure of the construct system form human identity and cannot be changed without a more extensive modification of the rest of the core structure (Kelly, 1955, according to Stojnov 2001). The core aspects of the process of organization operate on a covert and tacit level. People are often unaware of these processes, even though they guide their behavior. In addition, people are not aware of most of the things that happen in their mind because it primarily operates at a very high level of abstraction.

The third characteristic of constructivist metatheory is based on self-organizing processes of development, ie autopoiesis (Maturana & Varela, 1980, according to Stojnov, 2001). In addition to continually improving and elaborating individuals' adaptive strategies, self-organizing processes also include states of heightened disharmony, imbalance, and deterioration - sometimes referred to as "clinical disorders." In favorable circumstances and cases where learning abilities are not significantly impaired, the adaptation system may eventually succeed by rearranging some types of deep structures that will be sufficient to allow a shift towards a more sustainable process configuration and a new, dynamic equilibrium. In unfavorable circumstances, on the other hand, maladaptive and unsustainable behavior will be manifested. The practical consequence of these characteristics is reflected in the ability of self-organizing systems with depth and surface structures to actively resist changes in their central or core constructs (Kelly, 1955; Fransella, 1972; Guidano & Liotti, 1983; Mahoney, 1980, all according to Stojnov, 2001). Mahoney calls this property the self-defense theory of resistance (Mahoney, 1988,

according to Stojnov, 2005). This emphasizes the fact that resisting change has a natural and often healthy role in protecting the core processes of organization (and thus in protecting the integrity of the system) from sudden and far-reaching reconstructive attacks. Implicit rules that regulate the order of psychological processes in people (which at the same time enable and limit the understanding of the self, the world and their mutual relations), are often difficult to explain, let alone change. They represent the essence of psychological resistance because they are the result of the overall efforts of individuals to devise a constant flow of events and bring as much certainty as possible to its inevitable change. Regardless of whether the processes of self-organization are valid and successful in predicting or not, they are the only part of the experiential apparatus of this kind. Their obstruction can lead to the dissolution of the core constructs, and thus to a complete collapse of the ability to predict and perform supervision. This causes paralyzing anxiety, the consequences of which are catastrophic for the individual - and that is far worse than even the slightest predictability and certainty - even if it has its bad sides.

Core beliefs about understanding reality, identity, power, and values are especially resistant to change. In some cases, they become so important that the biological survival of the individual is subordinated to them, so it can be said that they are sometimes more important than life itself. They are therefore most difficult to change with or without professional help (Mahoney, 1988, according to Stojnov, 2005). Viewed together, the basic characteristics of the constructivist metatheory proposed by Mahoney depict a person who represents the embodiment of beliefs, convictions and premonitions that are in a constant process of development and change. They are quite different from the prevailing efforts of other psychological theories to identify in humans the underlying permanent structure that does not change much. Therefore, it can be said that the stated principles are characteristic of constructivism and different from most of the prevailing beliefs in psychology.

Disability

Throughout history, there have been four forms of disability: the first was acquired in wars, the second was a consequence of illness and trauma at birth, the third resulted from a conflict with the law, while the fourth was the result of accidents at work. Legislation against the disabled was restrictive and discriminatory. The rejection of the disabled was most often a consequence of the fear of disability, regardless of whether it was perceived as a violation of divine norms or only as a consequence of illness. Superstition often determined the extent to which disabled people would be accepted or rejected, as well as the methods by which they would be treated. There were many assumptions about the occurrence of disability in children, which were later rejected. Maternity age, parental alcoholism and frequent births have been blamed for disability.

Definitions and perceptions of causes of disability reveal the level of development of health and pedagogical policy towards the disabled as a social group. People with disabilities have always been generally considered in the context of disability compared to people without disabilities. The physical description of the disabled in the medical sciences ranged from correct disability observation all the way to making conclusions about disability on the basis of alleged anomalies. Medical sciences gradually rejected prejudices about the disabled, but that was a long process.

The problem of the history of people with disabilities is complex because they have been considered, and sometimes still are, a marginal group without the right to awareness related to their

position in the past and present. According to such prejudices, they are not able to reach even the outlines of knowledge about their own future. Writing their history is even more problematic as it encounters a misunderstanding of that part of society unable to recognize people with disabilities as a population that has all the rights to equal social treatment. Over the centuries, they were, at best, only an incidental consequence of poor health or a portion of war invalids swallowed by the darkness of anonymity even deeper than the one that surrounded a so-called "little man" in collision with a "great" history. There were two other forms of disability that, each for itself, caused new prejudices, fears and superficial assessments. The category of those disabled by the force of law was archaic, characteristic of the gross physical repression of the old and Middle Ages, although its derivatives in the form of public executions followed by torture of convicts survived until the 19th century, and included criminals sentenced to lose some body parts due to various crimes. Disability as a consequence of the verdict gave an additional seal of shame to the understanding of disability. Negative perception has only increased with the advancement of technology and the age of machines.

Disabled workers have emerged as a category of people who have been thrown out of the production chain by a work accident and turned into homeless people, prone to begging and wandering.

Throughout history, the position of the disabled has been subject to social change. Modern science does not know much about the social practices of dealing with disabilities in ancient societies. The elementary function of social protection of the disabled has always been transferred to the family. In cases where the family was unable to perform this function successfully, "vulnerable individuals perished or depended on the changing mood of the social environment" (Halmi, 1989, p. 14). However, certain forms of social protection were gradually transferred to the state, under the influence of the socio-political thought of the ancient Hebrew state, Egypt, Mesopotamia, ancient Greece and ancient Rome. According to Halmi, among the provisions of the Code of Moses and other preserved writings from that time, in addition to instructions for caring for persons in a state of a certain social need (poor, children without parental care, etc.), incapable of work are also mentioned and wealthy citizens are inclined to take care of them (Halmi, 1989, p. 15). One of the rarely preserved records of the oldest inhabitants of Mesopotamia - the Code of Hammurabi - determines liability in the event of a work accident. However, when it comes to this ancient culture, it remains unclear who took care of those who, due to the seriousness of physical or mental damage, could not enter into any "business relations" regulated by the said act. According to the testimony of preserved papyri from 2160. BC and documents from 1500. BC, as well as the preserved records of Pharaoh Ramses II, since the state was strongly influenced by religion, the ancient Egyptians practiced the act of mercy towards the afflicted (Halmi, 1989, p. 15).

Self-image and social support

Social constructivism and quality of life of persons with disabilities

The development of self-image is related to the need for respect and acceptance by the environment, and the greater the discrepancy between an individual's and the support from the environment, the worse the adaptation and general self-esteem. This shows that the image of oneself is influenced by psychosocial components that develop from childhood and are formed throughout life.

Harter (1990, according to Bošković, 2014) states that, in early childhood, children have a good perception of the image of themselves, and this lasts until the transition to early adolescence, where there is a decline in the positive image of themselves. The self-image stabilizes in the last years of adolescence and development of a young individual (Vasta, Haith & Miller, 1998 according to Harter, 1990). The support that children receive from other, important people also plays an important role in the development of their self-image. Social support can influence adaptation by protecting the child's existing self-image or it can directly affect the level of self-esteem (Sandler et al., 1989, according to Bošković, 2014). Harter (1986, 1990, according to Bošković, 2014) points out that the perception of support from the environment, i.e. the positive attitude of other, important people, affects the dimensions of self-perception in children. Social support refers to the degree to which other people treat a child as a person, love them as they are, care for their feelings, understand and listen to their problems (Harter, 1986).

The social environment also influences the frequency of stress, and it can be a factor that provides vital resources that an individual can rely on in stressful situations (Lazarus and Folkman, 2004). Social support can be defined as the available help of close persons or institutions in case of need (Lacković-Grgin, 2000). Social support has two aspects: structural and procedural, where the structure of support consists of social networks (i.e., connections with close people, especially family) and subjective assessment of the quality of social contacts. Measures of social resources predict adaptive outcomes better than measures of social contacts. Research confirms that adaptive outcomes depend more on quality than quantity of social support; they are a function of the perception of social support (Holahan and Moos, 1982; Vaux, et al., 1986). The social support process includes several types of support: emotional, respectful, instrumental, informational and social network support. Which form of social support will be represented depends on the nature of the circumstances as well as the members of the social network (Safarino, 1998). The effects of social support also depend on the nature of the need and the subjective perception of social support by members of the social network (Weatkins, 2001 according to Jokić-Begić, 2013). Family support most often has the function of positive emotional and instrumental support (Wills and Shinar 2000).

Several studies have suggested that strong emotional ties between young people and their families lead to high self-esteem and a positive self-image (e.g., Windle and Miller-Tutzauer, 1992), while other research links a positive self-image and high self-esteem with good relationships with students and peers (e.g., Buhrmester, 1990; Gottlieb, 1991, according to Bošković, 2014). Children, on the other hand, who do not have much support from both parents and peers, are at greater risk of developing a much worse self-image (van Aken et al., 1996).

Considering the influences of the social environment on the positive self-image development, self-esteem and self-understanding create the need to produce new starting points in meeting the needs of each individual by providing social support from the community. The creation of a social model of the quality of life of PWD also defines the prevailing philosophy based on the constructivist paradigm.

The constructivist model of quality of life respects the diversity of persons with disabilities and specific social communities, their interests, attitudes, motivations and value orientations. It is based on an individual's needs in creating a self-image based on individually perceived competence in a social context. The constructivist paradigm is based on researching and respecting the socio-cultural,

generational and other codes of the community within which PWD live and work, and the environment's impact on the self-perception of the disabled as individuals.

The constructivist approach presupposes a person's active attitude, as a way of comprehending, which is essentially related to cultural values. Starting from the philosophical postulates of the constructivist paradigm, in which a person is the subject of activities of the social environment, and thus influences the environment and changes it, an inclusive model of perceiving the quality of life of the disabled has developed. Inclusion as a movement, philosophy, model, way of thinking has stimulated many scientific, professional and public occupations in creating a different environment and active involvement of people with disabilities.

Social constructivism and quality of life of persons with disabilities

The issue of quality-of-life factors has been a popular topic in the last decade, both in the area of psychology, as well as in the field of other sciences that deal with people (Bednjak, 2010. according to Bošković, 2014). Today, there are a number of theories, approaches and definitions about quality of life, and research that deals with the study of quality of life. The World Health Organization (WHO, 1999) defines quality of life as the perception of an individual's position in a specific cultural, social and environmental context. Quality of life is a multidimensional concept when, in addition to objective factors such as social, economic and political, it is also a subjective perception and assessment of physical, material, social and emotional well-being, self-development and purposeful activity (International WellBeing Group, 1998, according to Bednjak, 2010). Prerequisites for a quality life are full and active participation in interaction and communication processes, as well as exchange within the physical and social environment (Krizmanić, Kolesarić, 1989, according to Bošković, 2014). Numerous studies have shown that the level of self-assessed subjective quality of life is on average within the range of positive and stable. People with disabilities who do not have a permanent decrease in the values of quality-of-life self-assessment are redirected to other values and areas of life, and compensate for the deficiency in another area (Albrecht, Devlieger, 1999, according to Bošković, 2014). This is confirmed by other findings from the literature that state the existence of a mechanism for maintaining the experience of subjective quality of life at a certain level, on the basis of which in 2000 Robert Cummins set The Theory of Subjective Wellbeing Homeostasis: A Contribution to Understanding Life Quality. The theory proves homeostasis as a control mechanism in which a person perceives their own well-being within a range strictly specific to the individual (Cummins, Gullone, & Lau 2002, according to Bošković, 2014). The fact that the level of subjective quality of life is limited to a certain level, leads to the scientific census that the level of subjective quality of life is homeostatically regulated to a predetermined range of values.

The theory of homeostasis emerges from the assumption that the experience of quality of life is stable at a certain required level which, regardless of the influences, remains stable. The breakdown of homeostasis can occur when the negative influences become so strong that they exceed the individual's ability to overcome them (Cummins et al., 2003, according to Bošković, 2014).

The relationship between different quality of life factors is described by Renwick et al. (2000, according to Bošković, 2014) through the concept of a holistic approach to quality of life. A holistic approach implies that different aspects of a person, physical, psychological, and spiritual, are interrelated with different aspects of the environment. In that sense, the quality of life of an individual

is viewed as a complex, integrated whole that arises from the relationship between individuals and their surroundings. Within this approach, quality of life is defined as a way a person has an impact on creating significant processes in their life (Renwick et al., 2000, according to Bošković, 2014). The authors further explain that the degree of "quality" or "well-being" that a person experiences in each of the areas of life is determined both by how much importance a person attaches to each of them, and by how much satisfaction they find. This means that the main influence on the life well-being experience has two factors: making choices and making decisions, and the range of available options for making choices and making decisions. Interrelated, they determine the degree to which a person feels in control of their own life (Renwick and Brown, 1996, according to Renwick et al., 2000). The previously described holistic approach in the quality-of-life determinants especially emphasizes the dimension of belonging to the community as the quality of relationships that an individual builds and feels in the relations between themself and the community (Bratković, Rožman, 2010, according to Bošković, 2014).

Subjective aspects of quality of life start from the subjective experience of one's own importance, formed under different influences. In people with disabilities, there is a close dependence and simultaneous psychosomatic interaction between external and internal stimuli. The reaction to disability depends on several factors, the most important of which are: personality structure, the influence of the environment, the type of impairment, work and professional activity, and age. The psychosocial definition of the notion of quality of life was created by researching the individual experience of "one's own good feeling". This implies individual perception of one's own life position, which contains insight into one's goals, expectations, cultural standards and one's own values. Given that the general concept of quality of life is multifactorial and independent of disease, its narrower determinant "quality of life" includes understanding the image of oneself and self-evaluation (Krizmanić, Kolesarić, 1989, according to Bošković, 2014).

The concept of inclusion and inclusive education

Unlike the model of integration as an incomplete attitude towards persons with disabilities, which results in a certain separation of these persons from the matrix of social events and socio-political and economic relations, the term "inclusive society" generally means full equality and inclusion of each individual in the community. In this sense, inclusion should be viewed from various aspects of social action: education, social understanding of persons with disabilities and the notion of individual values. Inclusion is a process of changing oneself and the environment in accordance with the dynamic understanding of the concept of each individual's well-being. Clark, Dyson, and Millward (2002) discuss the need to create a model in understanding learning difficulties, according to which learning difficulties and participation in social activities are the result of interaction between students and the context: people, politics, institutions, culture, and socioeconomic opportunities that affect their lives. That is why today we talk about inclusion as a concept, movement, theory, philosophy, educational practice and policy, which leads to different definitions in accordance with the point of view from which it is studied.

Inclusion as a social aspect represents individual-society relations and vice versa, and it can be more closely characterized as social inclusion. Freiler (2002, according to Cerić, Alić, 2005) lists three interdependent dimensions of social inclusion:

1. Spatial - social inclusion as close social and economic distance;

2. Social inclusion as a sense of acceptance and belonging; reciprocity and positive interactions - to be appreciated, to have a useful social role, to participate;

3. Functional - social inclusion as an increase in opportunities, abilities, competencies.

"Inclusion is not a set of strategies or topics related to a place. Inclusion concerns belonging to a community - a group of friends, a school community or a neighborhood" (Cerić, Alić, 2005, p. 23).

"Inclusion is a notion of an approach that emphasizes that diversity in strength, abilities and needs is natural and even desirable. It requires the development of sensitivity and the creation of conditions for articulating and meeting different individual needs, not just the needs of people with disabilities. No matter our individual diversity we all want to be loved, have a sense of belonging and be respected. Satisfaction with our own lives and acceptance by the people around us are indisputably key elements that influence quality of life. The inclusion model gives each community the opportunity to respond by having each of its members play an important role and be respected." (Cvetko, Gudelj, Hrgovan, 2000, p. 56, according to Bošković, 2014).

"Inclusion is a term that comes from democratic terminology and legal regulations. In a broader sense, inclusion refers to "a process that ensures that everyone, regardless of experience and life circumstances, can realize their potential in life. An inclusive society is characterized by a reduction in inequality, as well as a balance between the rights and obligations of the individual and an increase in social cohesion." (Center for Economic and Social Inclusion, 2002, p. 12)

Uditsky (1993) sees inclusion as a set of principles that ensure a person sees themself as a valued and needed member of the community in every respect.

The inclusion of people with disabilities is part of a large global human rights movement that calls for the full inclusion of all people with disabilities in all aspects of life.

Inclusion is an open process that can hardly be completed quickly and easily, and it actually seeks to remove barriers as a condition for equal participation of all people in the community. Thus, inclusion gained the meaning of basic democratic law because it advocates equality in education and schooling, meaning that there are no rejected, separated, stigmatized or handicapped.

Therefore, this kind of society does not imply equality of all, but that everyone, regardless of diversity, has the same right to participate and belong to society. Understanding equality in this unique sense contributes to the reduction and eradication of all forms of segregation, isolation and discrimination.

Within this notion, the thesis is advocated that a society with generally recognized and imposed common norms and values is most responsible for the marginalization and stigmatization of persons with disabilities.

The main goal of this approach is to make community members aware in order to ensure the dignified position of the disabled through systemic solutions and social support. No organized society

distributes existing cultural capital evenly and this causes differences in access to education and academic achievement. This perspective of observing the strata of society actually led Bourdieu (1998) to conclude that the basic purpose of education is the continuous social reproduction of segregation, which is based on power relations and privileges of one society. Following the logic of Bourdieu's view of the reproduction of the established order (1998) inclusion in education within the new paradigm framework is a kind of attempt to warn of the social relations reproduction.

The application of quality normative solutions in practice, based on modern theoretical approaches, often opens a lot of challenging and demanding questions. If the social model is based on a holistic approach, a constructivist paradigm and the need for social intervention, then it is a question of the direction of change, of changing value and governing structures, and the political will to democratize society. Namely, social intervention recognizes solutions to problems at four levels: national, local, academic and family level. The experience of developed countries shows that there is no successful implementation of the program without appropriate activities at all levels. The set of pedagogical, sociological and therapeutic requirements in the construction of the full inclusion model and development of quality programs presupposes the application of the principles of openness of development, full accessibility, individualization and personalization where a person, not their disability, is the starting point for creating needs.

The goal is to apply and develop a modern methodology for developing a pedagogical strategy, to develop and network programs for people with disabilities into a community's cultural and communicational structure, within which action is taken in the curricular cycle: examining needs, motivating, acquiring active community knowledge, horizontal and vertical exchange of knowledge, evaluation of achievements and development of new needs with emphasis that impairments determine the level of their potentials, but not their essential quality.

Changes in terms of an integrative and inclusive approach also previse certain legal solutions. Experience confirms that, if there is no support that can be recognized in the established and accepted beliefs, values, attitudes and intentions at the micro level, then the process of change will be difficult even in cases of legal decisions at the state level. Conversely, if there are no appropriate legal decisions, if there exists the will to make changes at the class and school level, changes and interventions will be possible. This interconnectedness of positive attitudes and social intervention, in a way, establishes a circular flow of change at the levels characteristic of most countries that have embarked on an inclusive approach.

Inclusive approach strategies constitute changes that rely on international and European documents of a socially developed society, in which one of the preconditions is the implementation of changes in society. Inclusion and exclusion are seen through three interrelated dimensions of improving society: creating an inclusive culture, creating an inclusive policy and developing inclusive practices. These dimensions were chosen to direct thinking about changing society (Ilić, 2009, according to Bošković, 2014). Each change plan should take into account all three dimensions. However, the creation of an inclusive culture represents a significant dimension with the aim of drawing attention to a different view of the social approach culture, in the sense of encouraging or slowing down development plans for people with disabilities. Culture, however, is central to creating plans for inclusive action. The development of common inclusive values and relationships of mutual cooperation can lead to changes in other areas.

Respecting modern theoretical starting points in understanding the concept of quality of life, we start from the fundamental hypothesis that an inclusive approach to the quality of life of a person in modern society can be successfully achieved through interdisciplinary programs. So, it is a question of the quality of the approach, first of all on the theoretical-methodological, i.e., conceptual level, and then on a realisation level. In line with modern theoretical approaches, the approach of inclusion of persons with disabilities is conceived within the constructivist paradigm. The goal is understood proactively and dynamically, in accordance with the cultural and socio-urban changes in the population and their authentic identity construction. As we are still in a transitional period and in the crisis of creating a new paradigm, it is necessary to develop strategies that will comprehensively look at the problems of the population of the disabled. Therefore, it is necessary to network programs for people with disabilities into the community's cultural and social communication structure, within which action is realized in the curriculum cycle (Kuhn, 1999).

Inclusion emerged as a movement to abolish the dual system of education, regular schools versus special ones, since dualism seemed a fundamental issue in education. "Inclusion is therefore a pedagogical-humanistic movement that strives to achieve full equality for every child and to ensure such conditions in school that will enable optimal development in accordance with his abilities." (Pašalic-Kreso 2003, p. 22, according to Bošković, 2014)

The basis for inclusive education and action policy is mentioned in some international documents such as the European Convention on Human Rights (1950), The United Nations Convention on the Rights of the Child (1989), the World Declaration on Education for All in Jomtien (1990), the Standard Rules on the Equalization of Opportunities for Persons with Disabilities (1993), The Salamanca Statement (1994) and The Dakar Framework: Education for All (2000).

Although the Statement does not explicitly mention the Convention on the Rights of the Child (1989), some of its essential determinants, such as the child's right to non-discrimination (Article 2), the child's right to live with theirr parents/guardians (Article 9), and the right to education (Articles 23 and 29), etc., are included in the conclusions of this Statement and The Salamanca Statement (1994 according to Cerić, Alić, 2005)-

The most important points of the Statement are:

1. Every child has the fundamental right to education and must be given the opportunity to attain and maintain an acceptable level of learning;

2. Each child has unique characteristics, interests, abilities and learning needs;

3. Education systems should be planned and educational programs implemented to take into account the wide variety of these characteristics and needs;

4. Those with special educational needs must have access to regular schools that would be adapted to them through appropriate pedagogical efforts to meet those needs;

5. Regular schools with such an inclusive orientation are the most effective ways of combating discriminatory attitudes, creating open communities, building an inclusive society and achieving education for all; moreover, they provide a more efficient education for most children and improve the efficiency and cost-effectiveness of the entire education system (UNESCO, 1994: vii, para. 2 according to Cerić, 2004).

Primorac (2003, according to Bošković, 2014), gives his vision of inclusive education, as a new theory within the educational process, taking as a thesis Vygotsky's teaching on the development of

learned concepts, and deals with defining the theory of inclusion. He concludes that inclusion is an unfinished concept and shows the characteristics of the complex. He considers inclusion to be an unfinished theory, offers some guidelines in the construction of inclusive education, and determines the directions of inclusive education. Furthermore, Primorac states that the approach of constructivism as a modern theory of upbringing and education corresponds best to inclusion as a concept and its action as a theory. In the context of the discussion on the theoretical construction of inclusive education, he starts from the following theses: the critical theory's starting point is the thesis that science is a part of social work; critical theory aims to clarify the social context of shaping social facts in order to change social relations.

Stubbs (1998, according to Bošković, 2014) states that inclusive education is a strategy with the ultimate goal of promoting an inclusive society where each individual is enabled to participate and contribute.

Slatina (2003, according to Bošković, 2014) considers inclusive education neither a theory nor a concept, but a movement that emphasizes respect for human rights and socially marginalized groups.

Pašalić-Kreso (2003, according to Bošković, 2014) states that inclusion is a pedagogical-humanistic-reformist movement that strives for equality of every child in accordance with their abilities.

A study conducted by Ryndak et al. (2000, according to Bošković, 2014) discusses inclusion as a philosophy or belief system that permeates the education system. On the other hand, some authors consider inclusive education as a theory, as suggested by Clough and Corbett's book (2002, according to Bošković, 2014) "Theory of Inclusive Education". This part discusses several theories of inclusive education, which are considered through five key perspectives, i.e. theoretical influences on shaping the idea and practice of inclusive education: medical-psychological model, social model, curricular approaches, strategies for school improvement, critique of studies on difficulties.

One of the most prominent representatives of critical pedagogy is Paulo Freire. The backbone of his theory in the field of philosophy of upbringing through the pedagogy of the oppressed is based on the assumption that man's ontological characteristic is to be a subject that simultaneously adapts and changes the world around him, thus constantly enriching his life both individually and collectively. Speaking about the problems of education of marginalized and disenfranchised individuals and groups, Freire states that they are not living outside society. They have always been inside the structures that they have been recognized to be a part of. The solution is not to integrate them into such structures, but to transform them so that they can become "beings for themselves." Furthermore, he states that no form of education can be politically neutral because the education system can always be used as a mechanism to encourage and maintain educational inequalities. (Freire, 1993, according to Bošković, 2014).

The analysis of the basic principles of inclusion and inclusive education aims to show that these ideas are not new; they are all-time human efforts to confirm oneself as a human being. This type of will is deeply immersed in the logic of ethics; the basic concepts are close to normative ethics and some of the normative sciences of upbringing and education. Within the normative science of education, the problem of principles was attempted to be solved by reaching objectively valid, all-time norms and values. Research shows that constructivist theory can contribute to the further development of inclusion and inclusive education (Jurić et al., 2001, according to Bošković, 2014; Milutinović et al., 2011).

Inclusive education is based on a social model of children's diversity and the creation of an education system that can respond to the individual needs of each child. "The key factor is flexibility - acknowledging the fact that children learn with different dynamics and that teachers need skills to support their learning in a flexible way. This includes using different methods to respond to the different needs of children, their different capacities and developmental dynamics." (Miles, 2002, p. 4). Proponents of inclusive education state that inclusive education is a human right that ensures quality and develops better social sensitivity (The Center on Inclusive Education, 2009). The problem of tact and respect for the specifics of each individual case inclusive education solves through individualization and adoption of individual educational programs for certain categories of students and for each student individually (König, Zedler, 2001, according to Bošković, 2014).

Inclusive education can be seen as a two-way process, which on the one hand refers to increasing participation and learning, and on the other hand to identifying, reducing or eliminating difficulties for participation and learning (Rajović, Jovanović, 2010). Suzić, 2003, (according to Rajović, Jovanović, 2010) implies the activities of the individual and society, as a process of learning and teaching in which there are relatively permanent and progressive changes of the individual in terms of social support and social inclusion. This process should not be understood exclusively as a school process, although it focuses on how school influences the period of growing up. Therefore, it should be understood as intentional upbringing and education, but also as spontaneous learning and self-education.

Higher education and quality of accessibility / Between the declarative and the implemented - students with disabilities in high school education

Universities are, at the same time, the initiators, but also the reflection of the society of which they are a part. According to various policies, strategies and declarations, which have been adopted in the last ten years at the European and world level, universities have the most important role when it comes to social inclusion are expected to make the greatest contribution to raising awareness of the socio-cultural dimension, which accompanies economic reforms and transformations. Normative definitions of the right to higher education (in the Universal Declaration of Human Rights, 1948, and in the Charter of Fundamental Rights of the European Union, 2009) most often emphasize that higher education must be accessible to all on the basis of "ability" and that it is necessary to ensure all preconditions in higher education in order to contribute to the application of these principles. Ensuring the right to education of persons with disabilities at all levels, in accordance with the individual needs of these persons and support within the general education system, contributes most to their academic and social development (Convention on the Rights of Persons with Disabilities, 2007). Ensuring equal access and the principle of equal opportunities in education is a global initiative to promote the right to education for all. The UN Organization for Education, Science and Culture, entitled "Education for All" and the goals and measures set out in the UN Millennium Development Goals, adopted by the members of the Council of Europe in 2003, clearly define the need to ensure all preconditions which will provide access to education to marginalized groups, including people with disabilities (Farnell, Kovač, 2010, according to Bošković, 2014).

Inclusion in higher education, in the last decade, has climbed on the list of priorities of higher education policies. Thanks to the goals set by the Bologna Process, the inclusion of students with disabilities in higher education is no longer a marginal topic. The principles of the Bologna Process are based on the issues of inclusion of all marginalized groups, including students with disabilities. The Bologna Process sets guidelines under the common name "social dimension", and refers to ensuring equal opportunities for marginalized groups when enrolling in studies, during the process of studying, as well as at the end of their studies. Emphasizing the need for a "social dimension" of higher education in the Bologna Process is set as the first on the list of changes in higher education policies until 2020 (Farnell, Kovač, 2010, according to Bošković, 2014). The guidelines of the Bologna Process have become part of the public policies of higher education in the European Union and beyond. This fact has direct repercussions on the process of developing an inclusive approach to higher education.

However, although there are shifts, Dolenec (2010, according to Bošković, 2014) warns that the Bologna Process has achieved very little in ten years in terms of including students with disabilities in the higher education system. At the same time, he states that the inclusive policy of the Bologna Process has so far received a primarily "declarative victory", but not yet applicable. Some authors believe that the reason for this is the existence of two theoretical notions of institutional habitus: the so-called inclusive institutional habitus, characterized by institutional measures contributing to ensuring equal educational opportunities, and an exclusivist institutional habitus that still depicts socially insensitive institutional measures (Doolan, Farnell, 2009, according to Bošković, 2014). The causes of the lack of creating an inclusive institutional habitus can also be found in Bourdieu's discussion (1998) on the reproduction of social inequalities in higher education. Unless more attention is paid to the social and cultural habitus of potential students, quality institutional measures cannot be created to ensure equal access to higher education. (Klemenčić and Fried, 2007, according to Bošković, 2014)

In a large number of policies, declarations or development strategies, which have been adopted in the last ten years, the social dimension of higher education is unavoidable. In the London Ministerial Statement, published by the Ministers of Education of the signatory countries of the Bologna Declaration in 2007 it was concluded that higher education should play an important role in reducing inequalities and increasing the range of knowledge, skills and competencies in society and maximize the potential of individuals for personal development and contribution to a sustainable and democratic society based on knowledge. In 2008, two important documents were published: "European Universities Charter on Lifelong Learning", that represents the commitment of the members of the European Universities' Association (EUA) concerning the European universities' awareness of the diversity and individual needs of students and their responsibility for adapting study programs, respecting the student-centered approach to teaching. The UNESCO organization of higher education, the International Association of Universities, has also published a recommendation act "Equitable Access, Success and Quality in Higher Education", which aims to increase the percentage of the population with higher education, as well as to enable wider access to higher education for persons underrepresented due to socio-economic status, race, nationality, age, religion, gender or degree of disability. Experts have identified the causes of inequalities in access to education and educational attainment, which are largely based on unequal starting positions of individuals entering the education system, and on differences in quality within education systems. Member States are committed to reforming their education systems with a view to reducing social inequalities, with particular emphasis on higher education. In this

education system, there is still a significant percentage of marginalized groups of students, including students with disabilities. In addition, special emphasis was placed on ensuring the preconditions for increasing access to higher education and ensuring fair access. This depends on the achievements of potential students in primary and secondary education. Based on the research, it was concluded that the achievements of potential students with disabilities during lower levels of education are weaker, which is the cause of their low representation in higher education (Divjak et al., 2008, according to Bošković, 2014).

A large number of authors believe that families belonging to higher socio-economic categories nurture the value and importance of acquiring better educational achievements and such a cultural habitus is adopted by children with disabilities, and that in addition to good preparation in previous education, family support is one of the important prerequisites for attaining higher education. In addition, such families can afford paying for a better education and providing children with everything they need to continue their education with better achievements. Students with disabilities involved in studying through university initiatives to increase access, also discover that they have not developed the so-called academic habitus that would facilitate their more successful integration into studies (Redmond, 2006, according to Bošković, 2014).

Expressed fear of failure to meet the requirements of higher education and fear of disruption of previous family and personal relationships due to going away to university affect the decision to continue education. Mechanisms to encourage greater entry into higher education (in addition to designing adequate financial support policies), according to **Murphy** and Fleming (2003), must be targeted at three key levels: educational institutions at pre-inclusion levels in higher education (to reduce disparities in student achievement) , employers (in order to ensure better employability of graduates) and the family, i.e. the local community (in order to better inform others about the purpose and importance of inclusion in higher education and to strengthen family support for studying).

The expectations set by higher education institutions should be provided by their own programs and projects to meet the needs of potential students and the needs of the wider community (Williams, 2007, according to Bošković, 2014).

With the goal of proclaiming increased access to higher education, the starting point is the analysis of trends in access to higher education, especially the analysis of injustices, as a key issue in the field of public policies in higher education. Based on these analyzes and research on injustice in higher education, new advances have been made in the precise definition of what is meant by the term "access" to higher education. The goal is to define the target groups themselves, research who they are and whether the goal is only to include those groups in higher education, and whether there is anything that can support the set goals. A broader consensus has been reached implying that, when it comes to access to higher education, the issue of retention in the education system and the successful completion of studies cannot be left out. Reflecting this shift in focus, instead of emphasizing the issue of "access" to higher education, a new term has been increasingly used in a number of international theoretical and public policy documents: "expanding participation in higher education".

With regard to social groups that are less involved in the higher education system, a consensus has been reached denying their limitation to socio-economic or other specific characteristics, implying that sections of the population that are traditionally less involved in higher education must be

identified. In this sense, the term that has become increasingly used for these groups is "under-represented groups". The share of a certain social group in the national system of higher education does not correspond to their share in the total population of that country (BFUG, 2007).

Measures adopted at the international level to expand participation include, but are not limited to: the European Commission, European Ministers of Education of all Bologna Process signatory countries, the Organization for Economic Cooperation and Development (OECD), the International Association of Universities - IAU, at UNESCO), and the European Students' Union (ESU). Common to all conclusions and initiatives is thinking about the student body structure, which will open access to higher education and the ways of successful inclusion of underrepresented groups in higher education.

Based on data on inclusion in higher education (e.g., OECD, 2008), special attention is paid to the circumstances on which the success of expanding participation depends: from the causes of reduced access, i.e. weaker inclusion of certain sections of the population in higher education, to the issue of high dropout rates, that is, the lack of encouraging retention and studies completion. Only when all the above is taken into account, one can speak of the integrity of the initiative to expand participation in higher education.

Relevant participants in the process of shaping higher education public policies in the international context have different approaches to the achievement of goals. The emphasis on expanding participation has gained particular importance in the Bologna Process, as the reform has been accepted by the education ministers of 46 countries. Although the recommendations in the ministerial announcements of the Bologna Process are not binding, they are encouraged through the open method of coordination. The goals and measures in the announcements become very influential in the process of defining and shaping national public policies of higher education. Regarding the definition of measures regarding expanding access to higher education, the Working Group first emphasizes that each of them must be subject to adaptation to national contexts and priorities (Farnell, Kovač, 2010, according to Bošković, 2014). Measures have to be in line with most of the identified causes of injustice in higher education, from social and cultural habitus (additional measures related to informing; adaptation of study programs) to economic barriers (all forms of targeted financial support), as well as poor results in previous education (flexibility of enrollment policies). It is noticeable that measures for action in the earlier stages of education (from preschool to secondary education) are not presented here. Those could prevent dropping out or failure in education, and encourage the continuation of education. However, the Leuven Communiqué explained that the measures taken under the Bologna Process "must be complementary to measures in other parts of the education system" (Leuven Communique, 2009, p. 2).

The link between the "theory" presented in the works of higher education policy experts and the "practice" of public higher education policies is solidly established in the Bologna Process documents, forming the basis for developing quality national public policies to expand participation in higher education in Europe. Finally, it should be emphasized that the Leuven Communiqué, advocating the commitment to quality in higher education, highlighted the theme "Social Dimension: Fair Approach and Completion" as top on the Bologna Process list of priorities for the next decade. It requires forming measurable goals by 2020, in terms of increased participation of underrepresented groups in higher education (Leuven Communique, 2009). A significant achievement is reflected in the fact that, from the numerous documents of all these participants, a broader consensus can be noticed

regarding the basic principles of expanding participation in higher education. This is primarily related to recognizing the need for national governments to make it a priority of public higher education policies. The need for an integrated approach, which takes into account all causes of injustice in access to higher education, was also emphasized. Collecting data on the causes and degree of injustice in higher education is a necessary basis for quality and targeted public policies in this area (Puzić and sar., 2006, according to Bošković, 2014).

Between the declarative and the implemented - students with disabilities in high school education

Concepts such as the right to education, inclusive education, the social dimension of education, academic environment adaptation, underrepresented groups in higher education, the principle of equal opportunities in education or education for all, are just some of the concepts that are becoming commonplace in international debates. discussions in the field of human rights, social inclusion and social development (Pavić, Vukelić, 2009, according to Bošković, 2014).

The principle of equal opportunities in education can be defined as equalizing the conditions associated with educational achievements so that all individuals have the opportunity to realize their abilities. This means that the educational achievements of each individual should be related to their abilities and invested effort (Pavić, Vukelić, 2009). In accordance with the mentioned concepts and pointing out the role of higher education with an emphasis on the social dimension, young people with disabilities are becoming the center of interest in creating the preconditions for equal opportunities in education. They represent one of the most vulnerable social groups, facing serious obstacles at all levels of education, especially in higher education.

Thus, the principle of equal opportunities includes not only formal equality, i.e., equal access to education in the formal-legal sense, but also the identification and removal of all social factors that are the result of social differences reproducing social inequalities by obtaining illegitimate educational qualifications. The equality of conditions, in the context of education, can be violated due to a number of ruling, social and cultural factors, which are often the cause for the creation of groups that cannot meet the set social goals without their social environment support.

Defining underrepresented groups in higher education stemmed from the need to redefine the student body, creating preconditions for equal access to higher education, and creating a positive political atmosphere at a university, thus incorporating positive social and legislative measures to raise the quality of life of people with disabilities. When it comes to higher education, it should be emphasized that the strongest factor in a quality career start is the completion of higher education, while the completion of secondary education is a key condition for social inclusion (Matković, 2009, according to Bošković, 2014).

The inclusion of students with disabilities in higher education is no longer a marginal topic. In the Bologna Process, it is climbing the list of priorities, and the same trend is already beginning to be felt in Croatia and the countries of the region. At the same time, she states that the Bologna Process deals with the issues of inclusion of underrepresented groups, including students with disabilities. In its basic documents from the Ministerial Conferences (Prague Communiqué 2001, Berlin Communiqué 2003, Bergen Communiqué 2005, London Communiqué 2007, according to Bošković, 2014), the Bologna Process sets out guidelines under the common name "social dimension" relating to ensuring

equal opportunities for underrepresented groups when enrolling a university, during studies, and at the end of studies. As discussed earlier, special emphasis is placed on removing institutional barriers for students with disabilities. Thus, the documents of the Bologna Process give space to the sociologically important topic of the quality of the academic environment and its impact on the quality of higher education of students with disabilities.

Quality of accessibility of the academic environment

Education should be a fundamental factor of social inclusion for all citizens (Council of Europe, 2003). In order to achieve this for people with disabilities, the design of an inclusive education system should be encouraged. It will be able to address the differences in the educational needs of children and people with disabilities, giving them access and success in the regular education system, from preschool, to higher and lifelong education.

There are four basic dimensions of education that, according to Tomaševski (2006, according to Bošković, 2014), the first United Nations envoy for the right to education (1998-2004), must be met in order for the right to education to be fulfilled in practice: availability, accessibility, acceptability and adaptability. Availability refers to the existence of a sufficient number of adequately equipped educational institutions and their regional distribution. In addition, the physical and economic accessibility, i.e., the accessibility of such institutions to all social groups, is especially important. Eligibility addresses the issue of providing study conditions that are in line with international standards and the issue of the quality provided by educational programs. Difficulties that educational institutions have realizing the right to equal access to teaching and the educational process are often recognized in insufficient financial capacity (technical equipment, availability of assistive technologies, hiring experts and teaching assistants, etc.), but also human capacity, or insufficient teaching preparation (teachers, assistants, associates) and non-teaching staff (employed in student services).

An accessible academic environment ensures adaptation to teaching methods, which enable students with disabilities to access academic activities in a way that does not compromise academic standards. Accessibility means everything that enables people with disabilities to live independently and participate in all aspects of life, just like others (Počuč, 2008, according to Bošković, 2014).

This definition of accessibility clearly indicates that there are real needs to create an academic environment in accordance with the needs of all students with disabilities, i.e., an environment that enables the development of social competence of all in the educational process and active involvement of students with disabilities. Social competence is, in fact, a state in which a person possesses the social, emotional and intellectual skills and behaviors that are necessary for that person to be a successful member of the group and society (Milašin, et al., 2009, according to Bošković, 2014).

A quality academic environment requires thorough involvement of all participants in the educational process and support system to ensure the development of interpersonal communication competencies This is a prerequisite for achieving quality interpersonal relationships within the academic environment. The level of interpersonal communication competence is the degree to which one's behaviors are appropriate to the situation and thus enable one to achieve their individual and relational goals. The success of achieving goals in each interaction largely depends on communication competence, which can be interpreted as achieving one's own goals, while at the same time striving for

other participants in the interaction to at least partially achieve theirs (Reardon, 1998, according to Bošković, 2014). Communication competence is a significant factor in the perception of the quality of interpersonal relationships, and affects the development of self-confidence, sense of self-worth, and social competence (Prilleltensky, Nelson, 2000, according to Bošković, 2014).

How much the previous research on the studying of students with disabilities, initiated activities and projects will influence institutions to include students with disabilities in higher education, depends on making detailed analysis of the cause for an insufficient number of these students. Some of the indicators may be: their demand for study programs, available resources, the number of students with disabilities, the success of students with disabilities, dropouts and more. At the same time, ensuring a quality academic environment, as a significant element in improving the quality of higher education for students with disabilities, requires changes in the academic environment from architectural adaptations, adaptation of teaching content, providing peer support, preparation of teaching and non-teaching staff to work with students with disabilities and professional support. Through a system of targeted education of all in the academic environment, preconditions are created for increasing the participation of students with disabilities in higher education. The participation of these students is based on the openness of all participants, respecting the wider social, cultural and social context of students with disabilities.

Although an individualized approach and meeting very specific needs may be the only correct way to support students with disabilities, there are also measures and procedures that can solve some key issues common to all students with disabilities, i.e., certain categories of students, most often defined according to their impairment (Kiš-Glavaš, Sokač, 2005, according to Bošković, 2014). The flexibility and competencies of teachers and administrative staff, accompanied by acquiring the needs and planned systematic action to meet them, are just the right approach. What contributes to raising the quality of the accessibility of the academic environment is the readiness and acceptance by the institution, where student support, inclusive and holistic teaching and the environment are crucial. Higher education institutions should undertake reasonable activities. This often depends on the circumstances in which individual students find themselves, on the institution's financial and other resources, and on the practicality and success of the necessary adjustments (Shevlin et al., 2004, according to Bošković, 2014).

Opportunities, access and the rights of students with disabilities in higher education are shaped by the level of support of academic and non-academic staff in meeting their specific needs. In the educational process, students with disabilities are entitled to the same type of support as in primary and secondary education (OECD, 2011), which will significantly compensate for the negative effects of their disability. Ensuring the quality of education of students with disabilities in higher education depends on the ability to accurately identify their needs, consistency in access and availability of services and expertise, equality in access to resources and the existence of inclusive culture and policies in higher education. Ensuring the quality of education also depends on the capacity and willingness of institutions to anticipate the needs of students and organize support. In most of Western Europe, students with disabilities have the right to learning materials tailored to their needs, staff support, transportation, counseling, and assistive technology.

Accessibility of the academic environment enables the development of knowledge as a precondition for personal development. Personal development refers to education, various skills, achievements, personal competencies. Ensuring the quality of education includes policies, processes,

activities and mechanisms that help higher education for students with disabilities get recognized, reflected and developed (Ivković, 2009).

Although all of the above exists in official higher education policies, there are still significant obstacles that prevent the quality participation of students with disabilities in higher education.

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