TeComp

Report on the empirical research conducted as a result of the project

November 2022

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**Strengthening Teaching Competences
in Higher Education
in Natural and Mathematical Sciences**

Co-funded by the
Erasmus+ Programme
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As one of the results of the project "TeComp – Strengthening Teaching Competences in Higher Education in Natural and Mathematical Sciences", the scientific research conducted during the summer semester of the 2021/2022 academic year can be singled out. Namely, motivated by (good and, above all, usable in teaching and learning practice) acquired knowledge and skills during the professional training "Educational Interaction and Communication in Higher Education", by the University of Ghent, as well as professional training led by professors from the University of Granada, colleagues came up with the idea to apply some of the adopted approaches for the evaluation of students' works in higher education.

After the colleague, assistant professor Aleksandar Milenković from the Department for Mathematics and Informatics implemented a pilot study at the Faculty of Science of the Kragujevac University as part of the Educational Software course and presented his observations during one of the meetings during the project, his colleague Jelena Matejić, an assistant of the Department for Computer Science at Faculty of Science and Mathematics in Niš, who was also thinking in the same direction, expressed an interest in conducting similar educational research at the Faculty of Science in Niš as part of the Introduction to Web Programming course.

The methodological framework of the research is reflected in the fact that the projects of students of the first year of Informatics, who are tasked with creating a website on a topic they receive by random selection, before being evaluated by the teaching assistant, go through a peer feedback process. Students were divided into groups of four members each. Students in each group listened to and evaluated the projects of their colleagues. The assessment was done anonymously, so that the students would be as honest as possible and the test results would be as realistic as possible. For this purpose, a platform was developed for dividing students into groups and their mutual assessment. The platform is one of the results of the TeComp project. You can find the layout and instructions for using the platform in English and Serbian language.

At the beginning of the course, students were given clear instructions on what criteria their project should meet. There were five criteria which are shown in the following table.

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Criteria	Below Average	Average	Above Average	Score
Clean code	The student does not master the basic concepts of code formatting. {0, 0.5}	The student masters the basic concepts of code formatting but does not divide the code into functional units. {1}	Well formatted and organized code. {1.5}	1.5
Header/footer, navigation	Header/footer and navigation does not exist or exists, but they are not functional. {0, 0.5, 1}	Header/footer and navigation exist but their functionality is partial. {1.5, 2}	The header/footer and navigation are fully functional and meet the needs of the website. {2.5, 3}	3
Tables, forms, pictures	Tables, forms and images do not exist or exist but they are not functional. {0, 0.5, 1}	Tables, forms and images exist, but they are not fully functional or the data in them is not transparent or well organized. {1.5, 2}	Tables, forms and images are fully functional, data is well organized and transparent. {2.5, 3}	3
Responsive web design	The website adapts to only one type of device (mobile only, desktop only or tablet only). {0, 0.5, 1, 1.5}	Most elements adapt well to different types of devices. {2, 2.5, 3, 3.5}	All elements adapt well to all types of devices. The elements are well laid out on the page. {4, 4.5, 5}	5
JavaScript functional part of the web site	Functional units on the page do not exist or exist but they are developed at a low level. {0, 0.5, 1, 1.5, 2, 2.5, 3}	Functional units on the page do not exist and are written correctly. However, not all parts of the application are covered by these functionalities. {3.5, 4, 4.5, 5, 5.5}	All pages are fully covered with correctly coded functionalities. {6, 6.5, 7, 7.5}	7.5

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During the semester, students developed their projects, in accordance with what they learned in the classes themselves. After the course, each of the students publicly presents the result of their project. As we mentioned earlier, each group had four students, and the public presentations of the projects were within the group. So, one student presented his project to three of colleagues. The students are assigned with forms with clearly defined criteria for which they should assess whether their colleagues answered that part of the task correctly and write any possible comments and suggestions. Each of the students writes three such reports, and receives three reports from their colleagues, during which they had to write a formative assessment for seven pre-defined criteria for every project. Then each of them writes a response to the received suggestions and comments and has a few days to possibly reanalyze their work and make certain changes. Feedback and responses to feedback can be presented graphically with the following diagram.
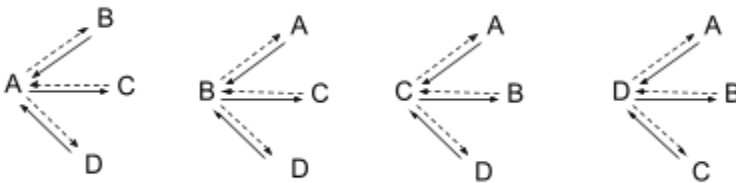
In the following table, you can see a questionnaire for students in the peer feedback process.

Question	Comment / Suggestion (provided by a colleague who evaluates the project)	Response to a comment / suggestion (provided by a colleague whose project is the subject of evaluation)
Does the created web site correspond to the set requirements of the project (contains header and/or footer, image, menu, personal presentation page, table, form, function and event)?		

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Is the site responsive? Does the page design adapt to the device on which the website is viewed?		
Does the content of the site correspond to the given topic?		
Is the website visually responsive? Is the colour selection harmonious and the text legible?		
Is the arrangement of elements on the page clear and intuitive (do you find your way easily and quickly find what you want)?		
Would you add any segment to improve the quality of the site?		
Opinion about the colleague's presentation (pace of the presentation, emphasis on the most important parts, precision and systematic presentation...).		

The teaching assistant evaluates the final versions of the projects (websites). At the same time, the assessment is carried out using rubrics, which consist of five criteria, where three levels of achievement are defined for each criterion, precisely defined and for which the students were informed before they started working on their project. The students' projects created by students who did not have the possibility of peer feedback were also evaluated using identical rubrics and the results of the research indicate that the students of the experimental group showed a significantly higher level of achievement during the implementation of this project assignment.

It should be pointed out that it was demanding for the lecturers to monitor all the process. First of all, the lecturer is present at all project presentations, where the lecturer personally notes the potential shortcomings of the project, as well as asks questions about the work. Then, as can be seen from the graphic representation, there are 24 interactions

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among students on the example of one group. Therefore, the number of groups that participated in the research should be multiplied by 24 interactions that take place within one group. During the second year of the study, there were 13 groups, which means that the lecturer had to monitor 312 interactions. Also, the lecturer reviews and evaluates the students' works after changes have been made to the projects.

According to this two-year research and mutual cooperation, colleagues have written the largest part of the scientific paper and it is expected that, after editing, they will soon send the manuscript to one of the journals on the SCI list. The working title of the paper is *On the influence on students' achievements and their attitudes towards implementation of the peer feedback process in the web programming course. During the first year of research,* 42 students (16 male and 26 female) participated, while 52 students participated in the second year of the research (46 male and 6 female). The research paper will present the results of improving the quality of student projects, as well as the differences observed between the first and second year of work.

This result from the aforementioned colleagues is a confirmation that the project "TeComp – Strengthening Teaching Competences in Higher Education in Natural and Mathematical Sciences" was really successful, that the participants adopted new methods and ideas and are already using them in practice, as well as that they are interested in examining the effects of new methodological approaches within the courses they are engaged in their professional work.

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