ACTIVE LEARNING METHODS IN THE EYES OF STUDENTS

D. Velichová, J. Gabková

Slovak University of Technology in Bratislava (SLOVAKIA)

Abstract

Short analysis is presented of findings from a survey held at the Summer school for students organized within the international Erasmus+ project Pythagoras. Students tested various active learning methods applied in teaching basic courses of mathematics in bachelor study programs at universities prepared by project partners. Their answers and views expressed in questionnaires after each activity were analysed and this important and irreplaceable feedback is presented in the paper. Comments from students serve as a valuable source of inspiration for the development of appropriate innovative teaching/learning methods reflecting students´ primer needs and requirements.

Keywords: Active learning methods, feedback from students.

1 INTRODUCTION

Paper presents findings from a survey held during the Summer school for students organized within the activities of international Erasmus+ project Pythagoras ([1]). During five days of this Learning-Teaching-Training activity groups of students from partner universities tested various active learning methods applied in teaching basic courses of mathematics in bachelor study programs at universities. Learning materials and activities were prepared by 7 project partners: Lucian Blaga University of Sibiu, Romania, The Porto Polytechnic in Portugal, Karlstad University in Sweden, The University of La Laguna, Tenerife, Spain, Aalborg University in Denmark, The Hellenic Mediterranean University in Chania, Crete, Greece, and Slovak University of Technology in Bratislava, Slovakia. The main goal of this activity was to receive feedback from students from several European countries with different educational systems revealing students´ opinion on active learning methods developed to enhance understanding and achieve steady knowledge in mathematics at the university level, and on their importance and role in education from the students´ perspective.

2 METHODOLOGY

Each day of the summer school, a different didactic approach was tested. Applied active learning scenarios were the following: escape room activity, mini-problem based learning, eduScrum method, gamification, pre-calculus survey, and stack exercise tasks. Each activity was prepared by one from the project partners, who was responsible for the day program and its evaluation. Students worked in small groups, while these were organized in different ways. In some activities the groups were mixed, composed of students from different countries, in others they worked in groups of students from the same university. All students were instantly informed about their performance in particular activities, and they were asked to express their opinion on the impact of each particular scenario on their knowledge gain or overall satisfaction with the learning outcomes. At the end of each day, after fulfilling the tasks, students answered prepared feedback questionnaires, where they introduced their views on the presented didactic scenario, their opinion on the particular method and its assumed impact on their knowledge acquisition, with ideas on possible improvements from the learners´ perspective.

3 RESULTS

The analysis of the answers in daily questionnaires is presented one by one in the following paragraphs. Students could express also their overall satisfaction with the attended activities by answering few questions in the prepared final questionnaire. All feedback was anonymous, students answered on-line. All questionnaires were prepared as on-line applications that were accessible using a unique QR code. Students were asked to express their opinions openly and honestly, with good intention that their views will be taken into account in the development of new educational activities to meet their needs and expectations. The aim was to receive fresh ideas from those actors of the educational process, who are traditionally more passive, playing the role of recipients of new knowledge without the opportunity to comment on the often quite ineffective methods, although used in a good faith that they are activating.

Overall satisfaction with the following session you attended

Figure 1. Overall satisfaction with the event activities, source [4].

3.1 Escape room activity

Escape room activity was presented during the first day, while it was not met with the full satisfaction of students. Organization of the day was not the best, as students were asked to work on-line with interactive game in the form of a Digital Escape Room without a proper introduction. While working in the computer laboratory they had to follow on-line instructions in unknown environment on how to get out from 3 escape rooms after solving few special tasks. These tasks were not directly related to some mathematical problem, and to solve them was a quite time consuming activity lasting the whole day. Some students did not fulfill the final mathematical task in the third room, as they were not able to get access to this last room and stayed without reaching any mathematical problem, information or knowledge. Their disappointment was also reflected in the mostly negative attitude expressed in this day questionnaire answers. Dissatisfaction stemmed from design issues within the escape room application, which hindered its effective execution. Students articulated these concerns in their feedback, highlighting the technical challenges they encountered and how these problems detracted from their overall experience during that particular session. Some of the comments: "*The Escape room didn't have a way to escape :(". "The first day's virtual escape room failed when it came to not crashing, not bugging, and enunciating the problems correctly. Otherwise, it would have been very interesting.".*

3.2 MiniPBL activity

The second day presented activity was specifically adapted PBL - Problem Based Learning method, in the form of miniPBL. Small problems related to specific environmental issues were presented to groups of students, whose task was to develop mathematical model of the described problem and find the solution, whereas the result had to be interpreted back to the practical applied problem solution. This approach was highly appreciated by students, who were interested in the real problems and liked the fact that mathematics might help to model the real life situations and suggest their possible solutions. In evaluation questionnaire the feedback from students was overwhelmingly positive. A significant majority of participants reported that the sessions were well organized, most students felt that the sessions met their expectations, reflecting a high level of satisfaction with the content delivered. A substantial portion of the respondents also indicated that the duration of the sessions was appropriate, the instructors effectively encouraged questions and fostered discussions during the sessions. This engagement is crucial for deepening understanding and enhancing the overall learning experience, suggesting that this activity supported the active participation and dialogue among students.
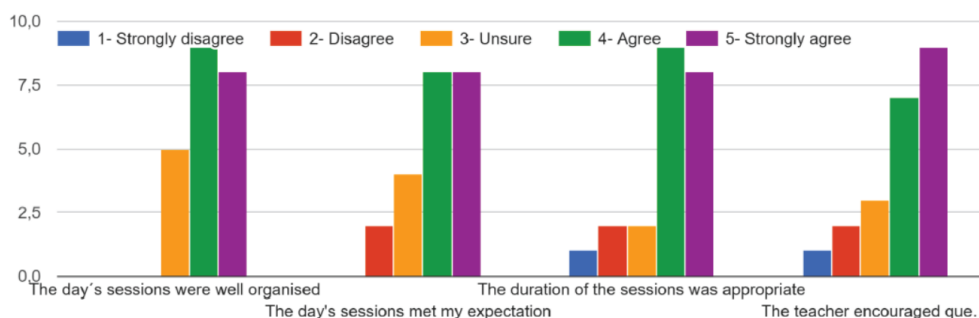
Do you consider that...

Figure 2. Analysis of answers in questionnaire on miniPBL activities, source [4].

3.3 EduScrum method and Pre-Calculus course

Two different activities were facilitated on the third day of the Summer school. The morning session of EduScrum facilitated by STUBA ([2], ([3]), was highly regarded and considered the highlight of the week. This method was marked by all students as the most suitable and relevant with respect to knowledge gain and satisfaction with the learning scenario. Students worked in groups as national teams, each team member solved one of the problems given in the sprint consisting of 4 traditional problems from Calculus I a II, and one applied problem related to environmental issues. Team members chose their leader - scrum master, who guided the team work and submitted collected team solutions. Working achievements of all teams were assessed, and the best teams with the highest point score were awarded small presents. All students were satisfied with the team work and appreciated the possibility to discuss problems together and share the workload.

The feedback on the afternoon Pre-Calculus course session was less favorable. Students commented on the inconsistency in teaching approaches during the afternoon session, stating, *"If one teacher tells us that teachers shouldn't teach while facing the board, then why does the next teacher do that?"* This highlights a perceived contradiction in teaching methods and suggests that greater consistency might enhance student engagement. Overall, less than half of the students who responded to the questionnaire felt that the day's sessions were well organized and their duration was appropriate, the sessions met their expectations and that the teachers effectively encouraged their engagement.
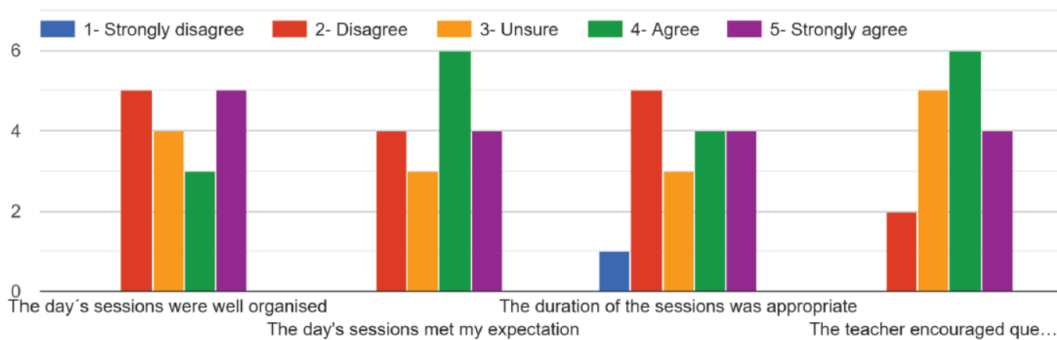

Figure 3. Analysis of answers in questionnaire on the third day activities, source [4].

3.4 Gamification

On the fourth day, gamification as a learning scenario was applied. Students solved individually or in small teams several problems presented as games, while their correct answers were awarded by points. Resulting point score was declared after each game, and winners of these games were awarded gifts. This activity, learning by playing, was regarded as interesting and very efficient with respect to fostering team cooperation in a pleasant, relaxing atmosphere. All students confirmed that the sessions were well organized and met their expectations, and their duration was appropriate. They also commended the teacher for his proactive attitude in encouraging questions and facilitating discussions. Students also gave positive remarks, as "*Very interesting topic, excellent presentation, engaging activities, and fun examples.*" and "*The interaction with students and competitive games really encouraged teamwork.*"
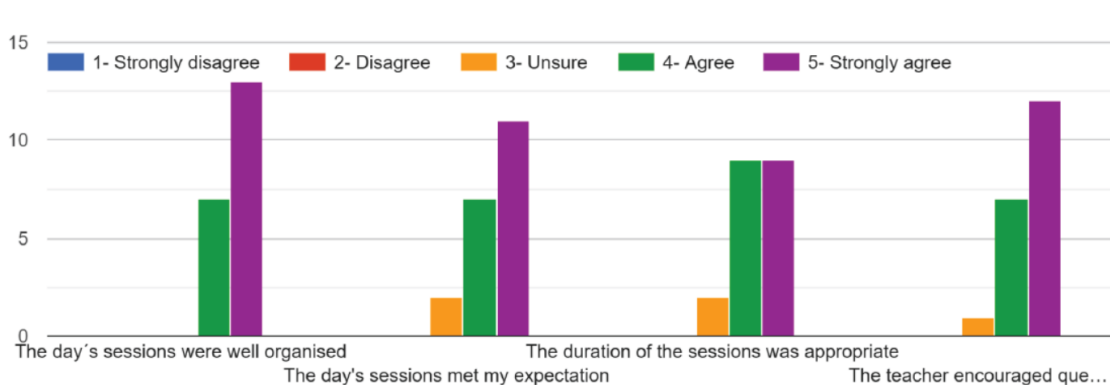

Figure 4. Analysis of answers in questionnaire on the gamification activity, source [4].

3.5 Stack exercise tasks

The last introduced learning activity was a Stack exercise. Students´ task was to solve several problems presented in Moodle environment as an exercise, in step-by-step mode. Inserted solutions were commented, any not correct answers were followed by hints that were aimed to help solver to find the right procedure or to use the correct formula. Opinion of students on this learning activity was very positive, most of them found this approach as helpful and instructive. Few students did not like that one could come to a correct solution without any knowledge gain, just following the given instructions. Majority of participants affirmed that the session met their expectations, highlighted its effectiveness in delivering the intended content, and the lead teachers' efforts in fostering the environment conducive to active participation. This feedback reflects a strong endorsement of the instructors' ability to engage students effectively and facilitate interaction throughout the educational session.
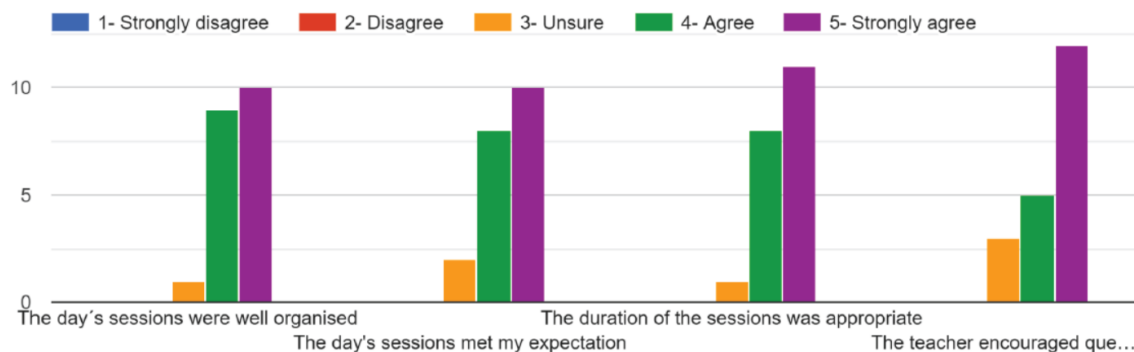

Figure 5. Analysis of answers in questionnaire on the Stack exercise activity, source [4].

4 CONCLUSIONS

Regarding the educational aspects of the presented learning scenarios, the majority of students identified group work as the most significant aspect of their experience and satisfaction in the knowledge acquisition process. They particularly valued the opportunity for collaboration and teamwork. Additionally, they highlighted the Summer school activity as a key feature that allowed them to meet and exchange knowledge with individuals from diverse countries. This intercultural interaction enriched their learning experience. They expressed a need for increased opportunities for team-building and ice-breaking activities to foster collaborations on international and cross-cultural levels.

All facilitating teachers identified the students' active participation as the most remarkable aspect of the experience. They valued the students' active involvement during discussions, consistent attendance, authentic enthusiasm for the explored topics and the provided valuable feedback. This high degree of engagement not only showed the students' commitment to their learning but also substantially enhanced the overall educational experience for everyone involved. The constructive contributions from the students created a dynamic interactive environment, fostering deeper discussions and enriching the learning process, ultimately benefiting both the teachers and the students.

Presented feedback received from participating students from different educational environments in various European countries indicated that the learning scenarios tested during this learning experience have met their intended objectives. All teachers agreed that such practical application of developed materials during the event provided valuable ideas for their refinement and improvement. This unique experience strongly affirms the relevance of hands-on experiences in the development and optimization of educational resources. Ideas received and confirmed by students who participated at the Summer school will be used for adapting introduced innovative active learning methods in the more effective ways that will be more suitable for learners.

The overall analysis of all questionnaires, final comments on received feedback and summarization of the outcomes of the project Pythagoras Summer school activity focused on testing active learning scenarios with a large group of international students presented in this paper and cited from the Pythagoras learning activity report ([4]) was provided by project partner EVM, consultancy company from Santa Cruz de Tenerife, Spain.

ACKNOWLEDGEMENTS

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