COUNSELING PECULIARITIES OF MATHEMATIC SUBJECT DURING THE INDEPENDENT LEARNING OF STUDENTS

Zita Baužienė, Janina Morkūnienė

Kauno kolegija - University of Applied Sciences, Pramonės pr. 20, Kaunas, Lithuania

Abstract

Students enter an institution of higher education with a different level of preparation for the studies of mathematics. A weaker preparation often hinders successful studies. The study programs provide for a certain number of hours that the student must use for independent learning. However, not all students succeed in using them effectively, to achieve the learning outcomes provided in the study programs. Therefore, the cooperation between teachers and students is very important in this case, and in order to perform self-study tasks, student counseling becomes a particularly significant form of cooperation. Empirical research allowed to identify the most effective ways of counseling, which enabled students to achieve the best learning outcomes. It should be noted that the study was conducted during a global pandemic caused by an outbreak of coronavirus infection (COVID-19).

Keywords: *counseling, independent learning, studies*

1. INTRODUCTION

One of the goals of the country's progress strategy "Lithuania 2030" is to provide conditions for learners to develop individually and to foster creativity, which would allow and ensure the implementation of common ideas of business and science (Valstybės pažangos tarnyba, 2020). The National Education Strategy for 2013–2022 states that Lithuanian education must become a sustainable basis for increasing the welfare of the state as well as energetic and independent people who are responsible in shaping the future of themselves, the state and the world in solidarity. It should be noted that Lithuania has made a significant progress in the field of access to education, because the data of the Lithuanian Department of Statistics for Lifelong Learning (2020) showed that in 2015 the educational level of males was 5.1 percent and in 2019 it rose slightly to 5.5 percent, while in 2015 the educational level of females was 6,5 percent, while in 2019 m. it reached 8,5 percent. These data show that the country's education is on the rise, but it should be noted that the dynamics of the level of education of females is faster than that of males.

Independent learning is learning where knowledge is acquired through the self-study (Baužienė, 2019). Many researchers have noted that student workload is measured in hours and work not during the lectures, but by the time and methods chosen by the student. However, it should be noted that the following factors are important for the successful independent learning of students: personal preparation level to study, motivation, proper organization of the study process as well as the quality of teachers' work (Baužienė, 2019). Another relevant aspect for successful studies that emerges here is cooperation between teachers and students, and student counseling during a self-learning -.

The research problem: *In what forms and ways does student counseling take place in the study process? Does student counseling lead to an improvement in the quality of studies? What factor determines the quality of student counseling??*

Research object - counseling students during the independent learning of mathematics.

The aim – to empirically substantiate the importance of counseling by teachers of mathematics on the quality of studies during the independent studies.

Research methodology and methods. The research is based on humanistic philosophy, philosophy of pragmatism, philosophy of constructivism.

A qualitative study was conducted in March-April 2020. The informants of this research were 120 first-year students of Kauno kolegija/ University of Applied Sciences studying: in the fields of social and technological sciences. Students provided reflections describing the difficulties they encountered in doing the self-study work, how they felt when consulting teachers and whether the consultation was meaningful in all cases and had an impact on their learning outcomes. The data was depersonalized and analyzed using the content analysis method, when findings that reveal the peculiarities of students' consultation with teachers are selected in students 'reflections. Selected findings were grouped into certain semantic nominal (subcategories), they were grouped together according to common meanings and divided into categories (Žydžiūnaitė, Sabaliauskas, 2017). During the study period, an emergency situation was declared in Lithuania due to an outbreak of coronavirus infection (COVID-19) (The Government of the Republic of Lithuania, 2020-02-26, Nr.26) and the studies were conducted remotely, therefore, student counseling was particularly relevant during that period. It should also be noted that the period of the investigation corresponds to the above-mentioned period, therefore, the findings of the study may have a characteristic of this situation.

2. STUDENT AND TEACHER COOPERATION

It should be noted that the cooperation between teachers and students is considered to be an important quality indicator of higher education; this is confirmed by the results of empirical research. It should also be emphasized that cooperation improves the professionalism of teachers, reduces stress and this guarantees a positive impact on students 'academic performance. In order to better understand and ultimately promote teacher cooperation with students, conditions for successful collaboration such as volunteering, shared goals and trust have been identified. In their research K. Drossel, K., et al. (2019) confirmed that successful collaboration is possible when teachers show initiative and create a trust-based learning environment E. P. Kim and M. Olson (2016) revealed that the quality of studies depends on the student's motivation to study and under what conditions this motivation is encouraged. The following factors were identified by the authors:

- *external motivation. (*good grades, honors, better employment opportunities in the future),
- *internal motivation* (student 's desire to acquire knowledge, competencies),
- *cooperation between students and teachers* (an appropriate atmosphere of trust between the teacher and the student positively motivates the student to study, it is stated that appropriate relationships are directly correlated with positive learning outcomes),
- *motivation for studies by the teacher* (assistance in identifying learning barriers and developing effective strategies to avoid or address them),
- *teacher competencies* (teacher preparation for studies, appropriate choice of methods, the ability to engage students' interest in the material taught, constant change, proper humor, creativity, patience, diligence during lectures).

A. Rutkienė and I. Tandzegolskienė (2014), pointed out that in the studies implemented by higher education institutions, while creating an environment receptive to educational learning, it is necessary to establish an open dialogue between the teacher and the student: negotiating the time needed, study content, teaching and learning methods, assessment, etc., evaluating students prior knowledge and skills level. Textbooks and lectures are not the only sources of information, and any personal deviation of the student from the subject taught is considered the norm, which confirms that the learner seeks to learn more than the minimum required. Therefore, it goes without saying that in the context of the new educational paradigm, a higher education teacher is not only the performer of his / her activity, but also the learner in his / her daily activities.

In summary, it can be said that the success of studies depends on the level of cooperation between teachers and students, which builds relationships that encourage both sides to learn and improve. In this case, the activities of the teacher as the organizer and coordinator of the study process are very important. It is also important that the teacher provides counseling in an environment based on mutual

trust, i. e. the student is given the role of an active participant, who can and must make decisions, but nearby is a teacher whose role is to advise and steer the student's field of learning in the right direction, which would ensure the achievement of learning outcomes.

3. DISTANCE LEARNING. WHY?

Pandemic, quarantine and distance learning are some of the most common concepts used in Lithuanian higher education institutions in 2020. Therefore, studies in Lithuanian higher education institutions were continued remotely. This situation was difficult not only for the students but also for the teachers. However, it should be noted that distance learning in Lithuania had been carried out before, but not as extensively as during the pandemic. Thus, Lithuania had accumulated some experience, and, based on the limited results of the research conducted by researchers, it has been observed that distance learning also ensures the quality of studies.

According to the method of information technology integration and work organization, three teaching / learning models can be distinguished (Donelienė, Turskienė, 2011. p. 53):

- *traditional* (taught at the agreed time and place, communication is direct).
- *distance learning (*all training materials are stored in databases, studies are organized without direct control, communication takes place via computer network*),*
- *mixed* (elements of traditional classroom teaching are combined with distance learning in a computer network environment).

According to A. Targamadze and R. Petrauskienė distance learning is a way of learning, which is characterized by physical separation between a teacher and a student and their activities performed at different time. This type of learning allows services to be provided where a person works and lives and at a time when he or she has the opportunity to learn.

A. Targamadzė and Petrauskienė R. (2008) distinguish the conditions under which distance learning is possible:

- adequate computer literacy,
- access to e. learning technologies,
- prepared digital study content,
- developed Internet connection.

Hughes J. E. et al. (2007) compared students 'knowledge of algebra acquired in a traditional and distance way of learning and found out that students who studied remotely had a higher level of the knowledge of algebra. The results of the research also revealed that the use of technologies in such courses increases the motivation of learners and enables to achieve better learning outcomes. Assessing the study achievements of individual students revealed that although there is a weaker preparation level for studies but studying in a virtual environment leads to higher achievement of learning outcomes. The results of the study also revealed that students studying in a traditional way more valued the coherence of the study process, involvement in the study process and cooperation, while students learning in the virtual environment emphasized the importance of the teacher support. The results of the study confirmed that students studying in a virtual environment can reach a sufficiently high level.

Data from a study by Hurlbult A. R. (2018) show that when studying in the traditional way, students generally received slightly higher grades than those who studied remotely. However, the results of the study revealed the interesting fact that the results were still better for those students who studied remotely and that they enjoyed studying in a virtual environment. Thus, these research results allow us to assume that the quality of studies is determined by students' motivation and a more attractive way of studying.

However, a significant moment needs to be noted: by combining the physical, digital and biological worlds new technologies offer a great promise and at the same time can be dangerous. The pace of this revolution and its variety encourage a new look at the development of states, value created by organizations and even rethinking what it means to be human. By sharing responsibility for a future in which innovation and technology will serve people, we will be able to raise humanity to a new level of moral consciousness. (Swab, 2017).

In summary, it can be said that new technologies have a significant impact on the development of society and their integration into society will determine what future professions will be needed and what employment opportunities will be there. Therefore, the implementation of distance learning enables students to get acquainted with various technologies and their application and realization possibilities, changes established relations as well as established practices and culture, destroys territorial boundaries.

4. DISCUSSION OF RESEARCH RESULTS

The study achievement averages of students studying in the field of social sciences who studied mathematics in the autumn semester of 2019-2020 are shown in Figure 1, where A, B, C denote a particular study program, I denotes the average of the interim assessment during the semester and SD is the average of self-study assessment at the end of the semester. It should be noted that the assessment of the mathematical achievements of the students of the mentioned study programs is cumulative, which consists of the assessments of the mid-term tests during the semester and a self-study work at the end of the semester. And the overall assessment is the average of the interim assessments and the self-study work assessment. It was observed that the averages of mathematics assessment of all study program students who studied social sciences during the semester were slightly lower than the average assessment of the self-study work. Only in the study program C the evaluation of mathematics self-study work differs from the average of intermediate assessments during the semester by almost one point. This difference can be explained by the fact that the program C was chosen by those students whose level of preparation is higher than of those who have chosen other study programs.

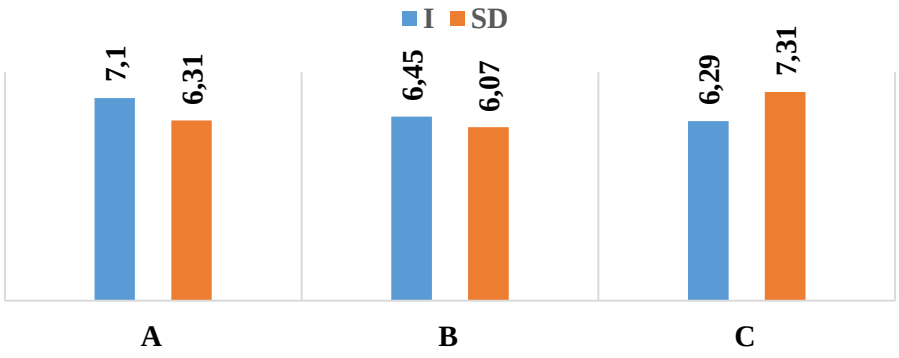


Fig. 1. The averages of study achievements of groups of the first-year students of three study programs who studied mathematics in the traditional way

(I- averages of interim assessments, SD- averages of self-study work; E; F; G – study programs)

The study method of the first-year students of the three study programs (see Figure 2) studying in the field of social sciences differs from the ones presented in the first figure in that half of the semester students studied in the traditional way and the rest of it in the distance and this difference was due to the quarantine. Thus, students were able to do their self-study work by consulting remotely – using a specific information technology video conferencing tool, and, in addition, the lectures were given remotely for the rest of the semester. Comparing the achievements of the students of study programs E, F, G, it was

observed that the evaluations of self-study work in mathematics of E and G programs were higher than the evaluations of intermediate assessments, and that there was a small difference in the evaluation of the self-study work of mathematics and the average evaluation of the intermediate assessments among the F study program students. Comparison of the self-study evaluations among the students who studied in the traditional and mixed ways revealed that the grades of students who have studied in a mixed way were higher. Therefore, it can be stated that the quality of studies of distance-learning students is not lower than that of traditional students.

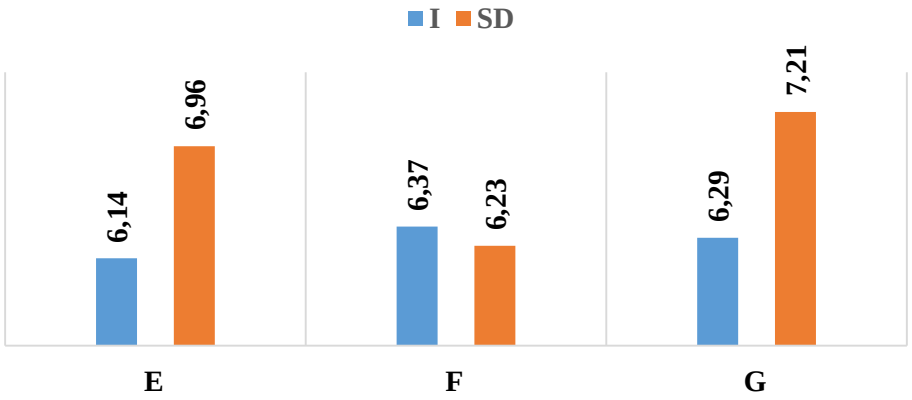


Fig. 2. Averages of study achievements of the groups of the first-year students of three study programs who studied mathematics in a mixed way

(I- averages of interim assessments, SD- averages of self-study work; E; F; G – study programs)

The averages of mathematics study achievements of the first-year students studying in the field of technology are presented in Figure 3., where I – denotes the average of the interim assessment during the semester; SD is the average of self-study assessment; E – exam grade averages; MR marks the autumn semester of the study program, MP – averages of spring semester assessments of students of the same study program. Comparing the mathematics achievements of students in the field of technology in the spring semester, the first half of which was studied in the traditional way and the second half in the distance, it was found that students achieved better results by studying remotely.

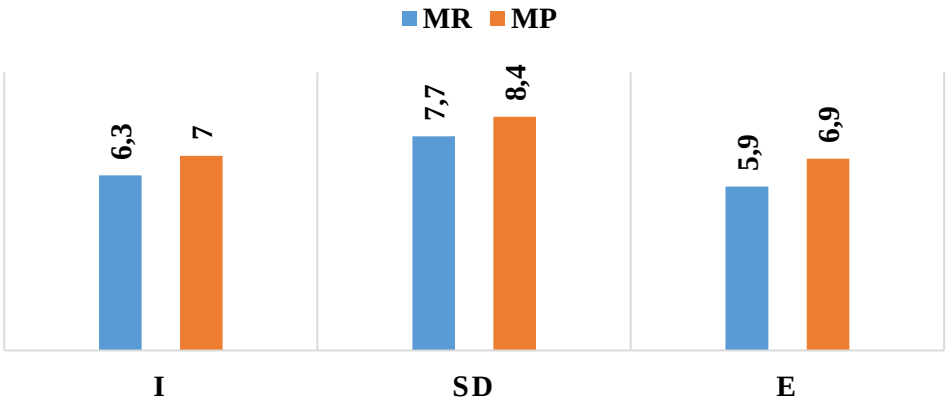


Fig. 3. Averages of mathematics assessments of students of the same study program for the autumn and spring semesters2 019-2020

(MR – autumn semester, MP – spring semester, I- averages of interim assessments, SD- averages of self-study work, E- average exam grade)

The analysis of the findings of the qualitative research was aimed at revealing the forms of student counseling, identifying the peculiarities of teacher counseling, and finding out what determines the quality of studies.

Table 4.1. Findings related to technical possibilities

Category	**Subcategory**	**Illustration**
Computer literacy	Lack of skills	*„Lack of work with Excel program <...>";* *„<...> text formatting...";* *„Plotting charts <...>, preparation of tables."*
Access	Lack of equipment	*„It is difficult to do practical work because I do not have the right equipment to communicate with friends, teachers."* *„The computer does not have a speakerphone and the phone does not receive a connection"* *„<...> can't show the place you didn't understand <...>"* *„<...> Slides jump through actions <...>"* *„<...> poor image quality is irritating to the eyes"*
Developed internet connection	Connection	*„Connection was often hampered during data collection <...>"* *„We quarantined in the village, and there was often no connection"* *„I couldn't always follow the lectures because there was no internet"*

Table 4.1 presents the category of findings - computer literacy, which includes the subcategory - lack of skills, lexical units illustrate that students were not able to fully perform certain operations in Excel, or had insufficient skills in text formatting, etc. However, when doing self-study work / preparing for exams students indicated that teacher consultations and the independent search for references allowed them to complete self-study work / prepare for exams. As a result, the average grade for self-study works of mathematics ranged from 6.23 to 7.21 (see Figure 2) and the assessment of mathematics exams - 6.9 (see Figure 3). This is confirmed by the findings in students' reflections, such as *„<...> it was very difficult at first and it took a long time to find out but the teacher helped <...>"; „<...> my knowledge of informatics and mathematics is weak, but I overcame it because the teacher was counselling me <...>"*.

The next category was access. This category includes computer hardware. Students faced difficulties in doing self-study work because, as they claimed: *„<...> I didn't have a camera ... speaker, so I couldn't communicate with teachers and colleagues <...>"*; it is also uncommon for the student's parents to work remotely during quarantine, for siblings to be taught remotely and for the family to have only one computer. Students also said that the traditional way for them to consult was better because *„<...> you are approached to show which place is unclear <...>"; „<...> timid to ask for everyone to hear, uncomfortable <...>"*. One more difficulty was revealed, which was *„<...> poor image quality <...>", „<...> I had to sit at the computer for a long time - my eyes were tired <...>"*.

A sufficiently developed online connection gives the student the opportunity to communicate and participate in lectures remotely. However, students noted in their reflections that *„<...> During the quarantine we lived with my family in the homestead - in the village, and here the internet connection is very weak <...>; „<...> I was unable to attend the lectures because there was no internet connection or it was poor <...>"*.

After summarizing the possibilities of students, which are related to the ability to work with computers and aspects of the operation of technical means, the following obstacles to successful studies have emerged.: insufficient computer literacy; lack of hardware; however, as shown by the results of the assessment of mathematics study achievements, teachers 'consultations and students' internal motivation had a significant impact on the success of self-study work / passing the exam.

Table 4.2. Findings related to the microclimate of the study process

Category	**Subcategory**	**Illustration**
Study content	View	*I had gaps in my knowledge of mathematics at school, I only saw the solution to the problem, and I had to sit longer to figure it out....<...>"* *„There were only tasks and answers, and how to solve them?"* *„I have gaps from the secondary school, so it's hard to delve into the theory."*
Counseling	Tools	*E-mails, various applications, telephone, notes on completed tasks, etc…*
	Empathy	*„sincerely helped"; „supervised by teachers in the course of self-study work";* *„the module coordinator allocated time for task completion"* *„I was shy to ask because I had a lot of gaps in my knowledge"*

The category presented in Table 4.2 is the study content, in the description of which the students presented the following obstacles in their reflections: *„<...> insufficient level of preparation for mathematics studies, it is difficult to quickly understand the solution when one sees the image of the solved problem <...>"*. A lot of students noted that *„<...> the insufficient learning of the school content of mathematics hindered the understanding of the theory, and if the lectures were held in the traditional way, this can be clarified more quickly <...>", „<...> the material in the slides is abbreviated, and I would need a more detailed presentation, so I had to work a lot on my own <...>".*

In describing the category of counseling, which is covered by two subcategories, namely: tools and empathy, students noted that they were consulted by teachers using various tools, such as: emails, video conferencing, telephone and wrote remarks and suggestions to the work.

Empathy - a subcategory that discusses the student's feeling while studying, examines the microclimate of the study process. Most students studying technology and social sciences indicated that *„<...> we were confused at the beginning of the quarantine <...>"; „<...> we got confused and didn't know what to do and how to proceed <...>"*. These findings confirm that students felt insecure at the beginning of the quarantine, however, "*after a few lectures, we felt that the teachers would help us and explain what we did not understand*. <...>" etc. The analysis of the findings also revealed that the role of the teacher is important for students both in performing self-study work and in planning time this is confirmed by *„<...> the teacher set the deadline for our work <...>", „<...> Teacher assigned the counseling time, when I could join <...>"*. A significant revelation was that the role of the teacher and his presence are very important for the students, „<...> I knew that I would always be helped <...>"; *„ There is no teacher nearby, it somehow doesn't motivate you to do your work... <...>"*. Students also noted that studying in the traditional way feels safe because „<...> a teacher is close <...>", and by studying remotely and being at home *„<...> there are always temptations to do something different and the weather is nice outside <...>"*.

In summary, the analysis of the findings showed that some students lacked computer skills and necessary tools and not all students had a sufficiently well-developed Internet connection at their places of

residence. Students also noted that the role of the teacher as a consultant is very significant in the study process. The analysis revealed the positive features of the distance learning that emerge in the students 'statements: „ The home environment is not suitable for work as it distracts, and in addition the weather outside is beautiful and there is also entertainment...<...>, but it is necessary to develop the will "; „ Useful experience in analyzing statistics, and later discussing them with teammates "; „ Learning from home will help in the future ", „ Experience working with applications <...>". These findings show students 'positive insights, which presuppose the significance of the distance learning experience for students' professional future.

It should be noted that both students and teachers were not ready for distance learning, as neither of them had such experience, but the statement: "*I learned to ask and communicate with colleagues and teachers in a virtual environment*." - confirms the positivity of the experience and the significance of cooperation, which can be considered an important argument for the development of distance learning and its diverse implementation in a study process in the future as one of the ways to ensure the successful realization of the needs of different students by using various information technologies that allow to reveal different abilities.

CONCLUSIONS

The analysis of the scientific references has shown that distance learning is a way of learning where the learner is physically separated from the teacher and their activities take place at different times and this gives the learner the opportunity tо study at the place where he lives and at a time convenient to him.

Distance learning allows a person to acquire a broader range of skills related to the application of a variety of technologies and it will enable students to prepare for a professional activity that must meet the demands of the future.

The results of the study revealed that students' computer literacy skills were insufficiently developed and there was a lack of technical tools during the quarantine period. However, good study microclimate in which the studies took place allowed the students to achieve the intended learning outcomes provided in the mathematics study programs. Counseling of students by e-mail, telephone and conference video are some of the most significant tools of successful studies that students have identified. Substantial findings in students' reflections testify to the importance of the teacher's role as a collaborative person who creates a sense of security in the study process. This is one of the aspects that affects the quality of studies and successful outcomes.

The analysis of distance learning of mathematics revealed this experience as a significant factor in the development of students' personal qualities such as responsibility, independence, willingness to work and cooperate, as well as knowledge and practical skills in the subject of mathematics, which can be described as a positive experience that will affect their professional career in the future.

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