doi.org/10.53656/math2023-5-6-com

COMPETENCY-BASED MODEL FOR CONDUCTING DISTANCE ONLINE SYNCHRONOUS EDUCATION OF THE STUDENTS

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Abstract. This research examines the problem of training future primary school teachers and math teachers in the conditions of the Covid-19 crisis. Based on the conducted 3-year pedagogical research, the author developed a didactical competence model for giving online synchronous lectures and seminar exercises in the disciplines of *Mathematics* and *Methodology of teaching mathematics*. The universalized model can be used to form and develop the pedagogical and mathematical competences of future teachers, as well as to conduct online classes with secondary school students and high school students. The model has been utilized in three variants: using of MS Equation's instruments, GeoGebra and OpenBoard. The competences acquired by the future teachers are described. A model to easily record quality math educational videos is proposed. It is concluded that traditional teaching methods should be applied, renewed, expanded and enriched with new technological means.

Keywords: didactics of mathematics; future teachers; model for education; online synchronous seminar exercises; video lectures; e-learning resources

Introduction

The changing world presents new challenges to educators who have to find a solution to the questions: How to continue education in extreme conditions without reducing quality? How can the learning technologies be changed, adapted and improved using the capabilities of new hardware and software? These are critical issues in response to which pedagogical research has been conducted from the beginning of the Covid crisis until March 2022.

The parameters of the research process

The object of the study is the competence-oriented educational technologies for distance learning in an electronic environment.

The subject of the research is the possibilities of innovative educational technologies for synchronous distance learning in an electronic environment, which form pedagogical competences in the students of the specialties "Preschool and primary school pedagogy" and "Pedagogy of learning in mathematics and informatics", in the disciplines "Mathematics" and "Methodology of mathematics education".

The aim of the present study is to develop an effective model for conducting seminar classes of university students in the conditions of remote access.

The tasks of the research are:

1. To outline the theoretical framework and to analyse the main concepts.
2. To analyse the possibilities of different software for quality conducting of lectures and seminar exercises, through which to increase the activity and motivation of the students.
3. To create a model for the formation and development of the competences of the future teachers during online synchronous seminar classes.
4. To implement the model in an online learning process and to analyse the results.

The conducted 3-year pedagogical research consists of *four stages*:

1. Theoretical study of appropriate theories for education.
2. Examination of the possibilities of various software products in distance teaching.
3. Building a model for online synchronous seminar exercises.
4. Monitoring the results of applying the model.

The following methods of pedagogical research were used: theoretical analysis and synthesis of ideas and models for electronic online learning; direct observation of the learning process of students – future teachers in mathematics (seminar exercises and practices); didactic modelling of objects and processes when developing the competency model for online learning; an empirical study to test the author's methodology; survey of students' satisfaction with the innovative technologies of the approved author's model, method of expert evaluation (opinion of university professors about the qualities of the model).

The concepts of *competency* and *competence*

The concept of *competency* is defined by the *National Centre for Learning and Statistics in Washington* as the combination of skills, abilities and knowledge required to perform a specific task (Jones et al. 2002). *Competency* is defined as a goal, as a predetermined normative requirement for the student's educational preparation, and *competence* as an achieved result, an acquired personal quality, i.e., already mastered competency (Vasileva-Ivanova 2015).

In the *European Qualification Framework*[1] and in the relevant *National Qualification Framework of the Republic of Bulgaria*, learning outcomes are defined as indicators of what the learner knows, understands and can do at the end of the learning process. *Digital competence* is manifested through the ability to use the digital technologies for learning, work and participation in society confidently, critically and responsibly. It includes information, media, communication literacy and digital content creation, safe Internet browsing, intellectual property compliance and problem-solving skills. *The European Commission* issues a new version of the *Digital Competence Framework 2.0* (Carretero Gomez et al. 2017) with eight levels of proficiency, according to the revised taxonomy of educational objectives (Anderson & Krathwohl 2001), with examples of use. Secondary school students should be able to search, select, retrieve, process, according to several criteria, information from various sources in order to complete a specific task, read, interpret and evaluate information presented in graphs, tables or diagrams[2]. In order to build *competencies* among students, their teachers must first possess it and create appropriate conditions for its formation and development (Kanchev et al. 2021).

In the project *Competencies and the learning of mathematics* the authors

(Niss & Hojgaard 2011; Niss & Hojgaard 2015) define the mathematical and professional competencies of future teachers as composed of eight components: *mathematical thinking*; *problem tackling*; *modelling*; *reasoning*; *representing*; *symbol and formalism competency*; *communicating; aids and tools competency.*

Georgieva (2012) has considered *professional competences* as a set of knowledge, skills and attitudes related to mastering and practicing a certain profession. In this regard, future math teachers must acquire mathematical, digital and pedagogical competence.

The professional competences of students as future teachers is a leading characteristic of their professionalism and is a multi-level, integrative formation of the personality, the set of systemic knowledge, reflective activity, a culture of dialogue, which is manifested in the readiness of the teacher to effectively solve educational tasks (Omarov et al. 2016).

Pedagogical competence goes beyond scientific knowledge and includes instructional strategies, classroom management, assessment methods, communication skills and the ability to foster a positive and inclusive learning environment. Teacher education institutions should adopt comprehensive and holistic approaches that promote the multifaceted development of future teachers.

Integrating technology into teacher education plays an important role in preparing future teachers for the digital age. Educators must be proficient in using educational technology, digital resources and online platforms to enhance teaching and learning. This includes using multimedia tools, interactive platforms and virtual learning environments to engage students and encourage active participation. The formation of the professional competences of students as future teachers becomes one of the most important problems of pedagogical education.

Possibilities of software products for application in education

In the early days of the pandemic, educators were looking for continuing education options based on their experience using software products. *Skype*, a pioneer in online live communication, is now part of *Microsoft 365*. It is regularly updated and enhanced so that it has more functionality, can share the screen and anyone easily use it in his/her preferred language. The sound and video are perfect quality. The user can install or use it through a browser and easily create an online meeting. From the shared link, learners instantly and seamlessly log into the online meeting without installing or creating an account. When the trainer uses the same link multiple times for one academic discipline, all written communication and video recordings are saved and accessible through that link to all participants.

When the user starts a meeting, even if there are no other participants in the conversation, the record video button appears. In this way, the trainer can easily create a video lesson, even if he/she does not have any software installed on his/her computer. Users can share their screen where they show and explain. The future teachers recorded videos this way.

Compared to the *BigBlueButton* platform, where recordings are in a specific file format, *Skype* recordings are in .mp4 format, so users do not need special software to play them.

A large number of educators use *Google Classroom* to publish learning resources, assign and check the students' independent work, and *Facebook's Messenger* to communicate instantly with parents and students at any time.

Creating educational mathematical video with *MS Word Equation*

Asynchronously presented, pre-recorded video lessons in a controlled environment interact many times more qualitatively and effectively with the physiological sensory analysers of the individual, which naturally leads to a more trouble-free perception and processing of information (Karagyozova 2022). To make it easier to remember the Sarrus rule for calculating determinants of the 3rd order (fig. 1), in 2019 a free available educational video[3] was created, which

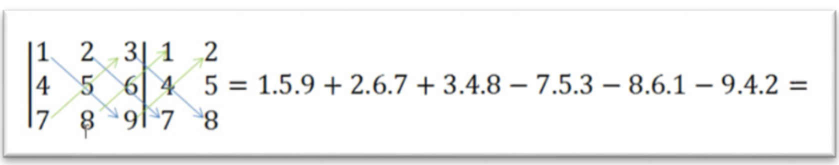


Figure 1. The video *Rule of Sarrus* for calculating determinants

received positive feedback from students. They comment that it is much easier, and they quickly understand and remember the algorithm.

When the goal is to make a short and precise video, more time is needed for its preliminary preparation. Repeated recordings are made until the desired quality of the record is obtained.

The technology for creating a mathematical video includes the following steps:

1. A detailed solution to a problem is written using the tools for writing mathematical symbols – *Microsoft Word's Equation*.
2. Sequentially is deleted individual blocks of the solution, starting from the end to the beginning of the document.
3. Arrows can be added to direct attention to important parts.
4. Start recording a video with the free *Open Broadcaster Software*[4] (*OBS studio*).
5. With the *Undo* button, the deleted is restored and the rules are explained verbally.

Normatively regulation of online learning

In March 2020 year, the Rector of Veliko Tarnovo University decreed that students' access to electronic learning resources should be done through the implemented university system "*E-student*", and *Microsoft Teams*, *Microsoft Outlook*, *One drive*, et al.

MS Teams can be used online through a browser or installed as an app. The buttons make it easy to start a conversation (*Chat*) and create a classroom (*Teams*) for collaboration. The presenter can share his/her entire screen or a separate window so that he/she can simultaneously see user reactions while showing a specific application. Another advantage is that several participants can write simultaneously in one common environment – *Microsoft Whiteboard* replaces the class board. For attendance control, *MS Teams* generates a file with all participants and the time they joined and left the event.

With one click, the lecturer can start recording of the synchronous lecture or exercises, so that student who could not to participate in the fixed classes has the opportunity to learn from this video through the browser. After the seminar exercise, the student can listen again and stop where he/she needs more time, go back and listen several times to the parts that are not clear to him/her. There are options to set the playback speed. The days before the exam he/she can recall the teacher's explanations. Thus, learners work at a pace suitable for them.

MS Teams' developers have made it easier the saving process so that videos are automatically stored to the *OneDrive* account of the person who started them. From his/her profile, the owner can control the expiration period of the files and set different access rights.

University lecturers can reuse the video lectures. In this way, the saved time can be used to search for the latest educational resources, learn new software, assign different activities to learners and control the quality of performance.

Other handy tools are *cloud spaces*. Thanks to them, all files are always with the owner when he/she is connected to the Internet. He/she does not need external data carriers that he/she may forget or break, or that the available device cannot make contact with them. To store and share files, teachers use *OneDrive*, *DOX.bg* and *Google Drive*. *OneDrive* provides three convenient sharing options: anyone with the link can open and copy; only people in the organization; certain people in the organization have access. The owner decides whether colleagues can only download or collaborate by editing shared documents directly online. The lecturer can create a shared folder where students can quickly add their folders/files so that from the moment they are copied, the teacher can review and check completed assignments. The files in this folder are accessible to all students and thus they can collaborate.

Building a model for online synchronous seminar exercises

The advantages of synchronous distance learning in promoting valuable educational experiences are thoroughly reviewed and explored in Karagyozova's (2022) analysis.

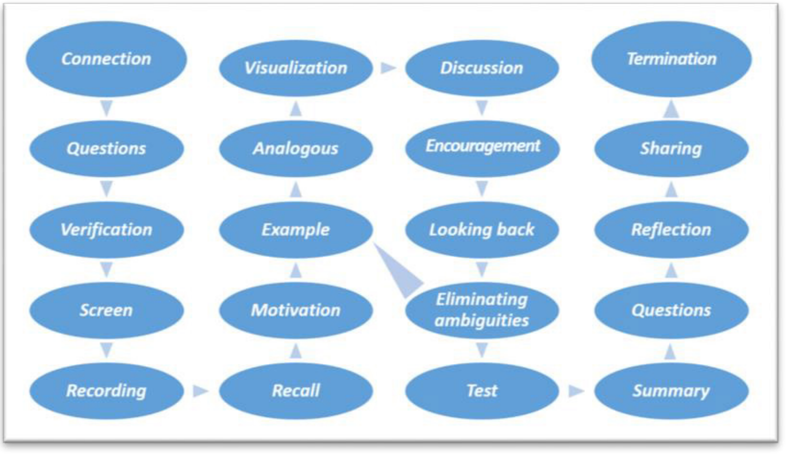


Figure 2. Competency-based model for conducting online synchronous education

Based on in-depth observations, detailed comparisons and extensive analyses of the use of various innovative educational technologies and software, a comprehensive competency model for conducting online synchronous seminar exercises has been developed. The purpose of this model is to improve the effectiveness of online synchronous learning. Although, different disciplines may use partially different approaches, the global model consists of the following basic blocks (fig. 2):

1. Connection: At the beginning of the online synchronous seminar, both the students and the teacher can access a conversation platform by clicking on a previously created and shared link in the university's electronic system.

2. Questions: Once the connection is established, students have the opportunity to ask questions related to the studied topics. The trainer who facilitates the workshop answers these questions, clarifying any uncertainties, concepts and filling gaps in understanding.

3. Verification: The trainer conducts a review process to assess the students' knowledge and skills acquired from the previous lessons. This helps ensure that everyone has a solid foundation before moving forward with new knowledge and gives students the opportunity to reinforce their understanding of already learned content.

4. Screen sharing: To enhance the learning experience, the lecturer shares the screen of his/her computer with the participants. This allows everyone to have a clear view of the resources or presentations used during the workshop. A teacher can effectively visualize key concepts or demonstrate the use of specific software or tools.

5. Recording: Initiating the recording of the event allow the presenter to control the sharing options and expiry period. The videos provide flexibility for subsequent asynchronous learning and deeper reflection, as students can review the recorded at their own tempo.

6. Recall: Through verbally based methods, the instructor prompts students to recall specific theories or concepts that will be used during the current lesson. This step serves as an updating and ensuring that participants have the necessary knowledge to effectively absorb the new educational theory, notion and skills.

7. Motivation: The trainer emphasizes the importance of learning the upcoming knowledge and skills in order to arouse the interest and enthusiasm of the participants. Students are convinced of the need for the new knowledge and its practical application in order to increase their learning motivation, personal commitment and active involvement in the learning process.

8. Example: The lecturer provides examples or practical demonstrations to illustrate how to work with new software or solve a given task or a methodological problem. Through detailed explanation and interaction, the lecturer encourages critical thinking and requires participants to apply the necessary knowledge to understand and address the presented challenges.

9. Analogous activity according to the sample: To reinforce understanding and encourage active learning, students are assigned similar tasks for individual or group solutions. They work on these assignments, applying the knowledge and skills acquired during the workshop. This approach allows the participants to engage in practical application of the learned.

10. Personalization through visualization: Students are selected by name to verbally explain and dictate parts of their solution to the task. This encourages active participation and reduces potential hesitation among students who may be afraid to share their ideas. During this time, the presenter writes the suggested steps in the file containing the text of the problem. Through the shared screen, all participants immediately see the individual steps taken to solve the problem, promoting a collaborative and interactive learning environment.

11. Discussion: The accuracy of the recorded solution is assessed through group discussion. Participants evaluate and analyse the steps provided by their peers, identifying the strengths and weaknesses of the taken approaches. This discussion also serves as an opportunity to explore alternative solutions or recording options. Critical thinking and in-depth understanding of the subject is encouraged.

12. Encouragement: In a short time, the teacher provides feedback to the students to assess their competences and activity; stimulates personal reflection with positive evaluations of active participation, correct decisions, original methodological ideas. Assessment also takes place here, with the instructor noting active participation on the seminar attendance list, ensuring that students receive credit for their engagement.

13. Looking back: The trainer reviews the solution process and summarizes the key steps taken during the workshop. By pointing out specific points or highlighting important aspects, the trainer reinforces understanding of the solution methodology. This step helps to consolidate the knowledge gained and ensures that participants have a clear understanding of the problem-solving approach.

14. Eliminating ambiguities: At this stage, students have the opportunity to ask specific questions related to the studied topic. The discussion goes through an active disputation between the students, asking provocative questions by the teacher and clarifying the answers. The aim is to address any remaining uncertainties and remove ambiguities in understanding, ensuring that all participants have a solid understanding of the topic.

Transition: Steps 8 through 14 are repeated several times as part of a cyclical process that provides opportunities for students to encounter different scenarios, apply their knowledge to different tasks, and hone their problem-solving skills.

15. Test: Short tests are conducted to assess the level of understanding and mastery of the learning activities. These tests assess participants' memorization, understanding, and application of the workshop content. They serve as checkpoints to measure individual progress and identify areas that may require further attention or clarification.

16. Summary: Participants are given the opportunity to summarize and articulate what they have learned during the specific seminar exercise. Visual flowcharts are presented for summarizing. This step encourages reflection and active engagement as students express their understanding of the concepts. The summary also helps to reinforce the key points and improves the consolidation of the learning content studied.

17. Questions: Participants are given the opportunity to ask new questions related to the seminar topic or other areas, which will gradually eliminate gaps in knowledge and skills and ensure stable preparation for the exam session. This step ensures that any remaining doubts or queries are addressed before the session ends.

18. Reflection: Both the trainer and the trainees participate in a self-critical and retrospective analysis of the actions and learning processes undertaken during the workshop. Reflective practice involves evaluating one's own performance, identifying strengths and weaknesses, considering alternative approaches or strategies for future improvement. Metacognitive skills are encouraged, and the overall learning experience is enhanced.

19. Sharing: The finished text file containing the summary solutions and a link to the recording of the seminar are saved in the electronic system of the university. This step ensures that workshop materials and resources are available to participants for future reference. The shared files are available for self-study by students absent from the synchronous online session.

20. Termination: The trainer ends the seminar by thanking the trainees for their active participation. Students are encouraged to continue studying the relevant topic and the instructor offers strategies for independent work and further research. At the end of the workshop, all participants expressed positive wishes, ensuring a positive learning environment and enhancing feelings of friendship, proven achievements and a positive outlook.

Depending on the specific disciplines and software tools used, steps 8 through 10 of the general model may vary to meet unique requirements.

From the competence model for online training described in the theoretical part, in the experimental stage, three technologies were identified as the main ones and were tested. This adaptability ensures that the model remains relevant and applicable across subject areas, enabling teachers to tailor their teaching strategies accordingly. Their characteristics and learning opportunities are presented below in the exposition.

Technology №1. Using Microsoft Word's Equation instruments

The main features and capabilities of these tools are:

• The *Equation Editor* provides a wide range of mathematical symbols, operators and structures that can be selected and inserted directly into the document.

• Unlike *LaTeX*, where the user must type individual characters from the keyboard to render a mathematical expression, *MS Equation* has a graphical interface.

• These math symbols can be easily copied and pasted into other *MS Office* applications, such as *PowerPoint* and *Excel*, providing seamless integration into different files.

The steps from the basic model are transformed as follows:

In step 8, from the general model, a prepared *Word* file with the conditions of the mathematical tasks is opened. The teacher uses the *Equation*'s tools to record the solution to the problem (fig. 3). To save time, he/she can copy part of the solution and change the numbers in the next step of the solution. While writing, he/she simultaneously explains the steps and concepts involved. This allows students to follow and grasp the concepts being taught. As students acquire the necessary knowledge, the teacher engages them by asking questions to ensure their understanding.

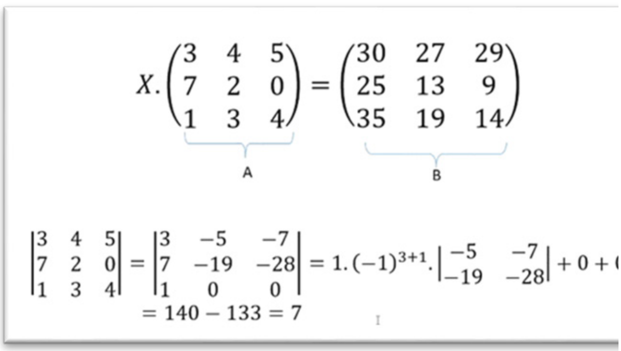


Figure 3. Using Microsoft Word Equation instruments (a part of the video)

In step 9, the trainer poses a similar problem for the students to solve independently. They record the decision on a piece of paper.

Moving on to step 10, an individual student is chosen to dictate parts of the solution. The trainer records the dictated decision in the *Word* file that is displayed on the shared screen. This immediate visibility allows participants to observe and understand the individual steps taken to arrive at the answer. Also, if the learner captured his/her written solution on a piece of paper using a smartphone, he/she can share the image in the chat for quick reference. The teacher can open the picture on the shared screen and ask the student to explain orally, thus making sure that the person understands and can explain the solution.

Technology №2. Using Microsoft Word, GeoGebra and graphical tablet

After testing and comparing different ways of conducting online seminar exercises, it turned out that when solving a geometric problem, technology №2. proved to be more effective. It introduces additional steps to the basic model.

In step 8.1 a file containing a previously written text of a methodical task is opened. The teacher copies the condition of the geometry problem into *GeoGebra*.

Moving on to step 8.2, the trainer demonstrates and explains step by step the process of constructing a drawing in *GeoGebra*. Students are taught how to effectively use the tools of the software (fig. 4).

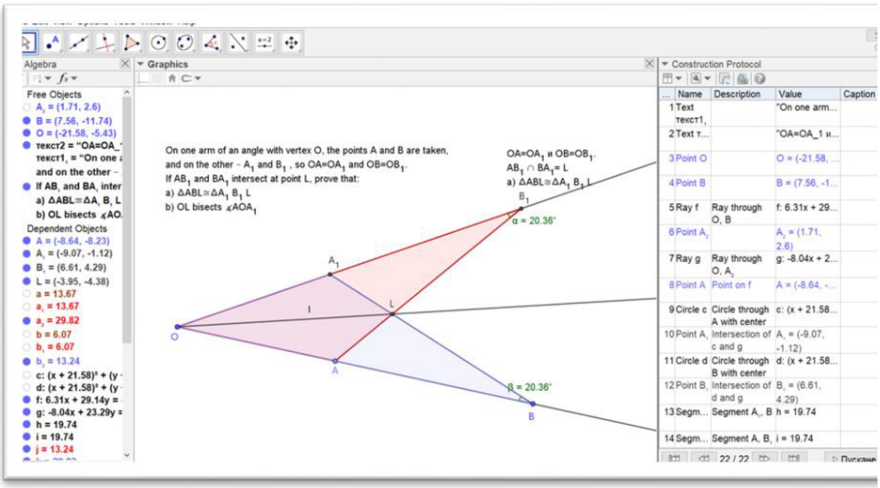


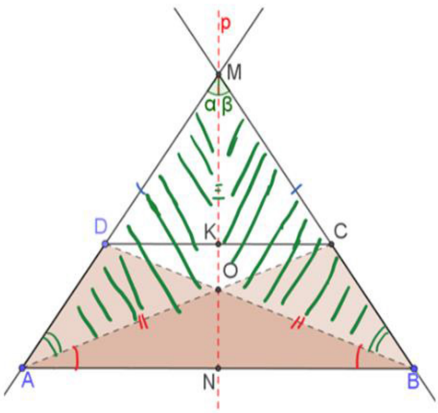
Figure 4. Synchronous construction of a drawing in GeoGebra

In step 8.3, the finished drawing is captured using various methods such as a keyboard button or the applications *Lightshot* or *Snip & Sketch* or the built-in

Windows "*Snip Tool*". The drawing is inserted as a picture in *Microsoft Word* and any further reasoning or annotations can be done with the digital graphic tablet using a stylus. This allows for further explanation and illustration of the solution process (fig. 5).

Task 1. To reveal the structure of the math problem and draw up a solution plan:

„An isosceles trapezoid is given. Prove that the line defined by the intersection of the diagonals and the intersection point of the extension of his hips is perpendicular to the base and bisects it."



Given:	To prove that:
$ABCD$ – trapezoid $AD = BC$ $AC \cap BD = O$ $AD \cap BC = M$ $OM \cap AB = N$ $OM \cap DC = K$	$OM \perp AB$ $AN = NB$

Solution plan:

1. ΔABM isosceles triangle
2. $\measuredangle\alpha = \measuredangle\beta$
3. $OM \perp AB, AN = NB$

Figure 5. The finished drawing is transferred to MS Word

Step 8.4 involves doing methodical work on the task. Reflections, discussions and additional annotations are recorded using the tablet and pen tool from *MS Word*. This collaborative approach facilitates active participation and improves students' understanding of the methodological problem-solving process (fig. 6).

Technology №3. Using OpenBoard and a digital graphic tablet

This technology is also applied to geometric tasks, but when the task does not require a complex geometric drawing. It is more convenient to use the free software *OpenBoard*, which provides the ability to write with a digital graphic tablet on separate white sheets. They are reordered and automatically saved to a new file. The user can quickly switch to other open windows on the computer (a small toolbar remains from the program) and write on them or cut part of them.

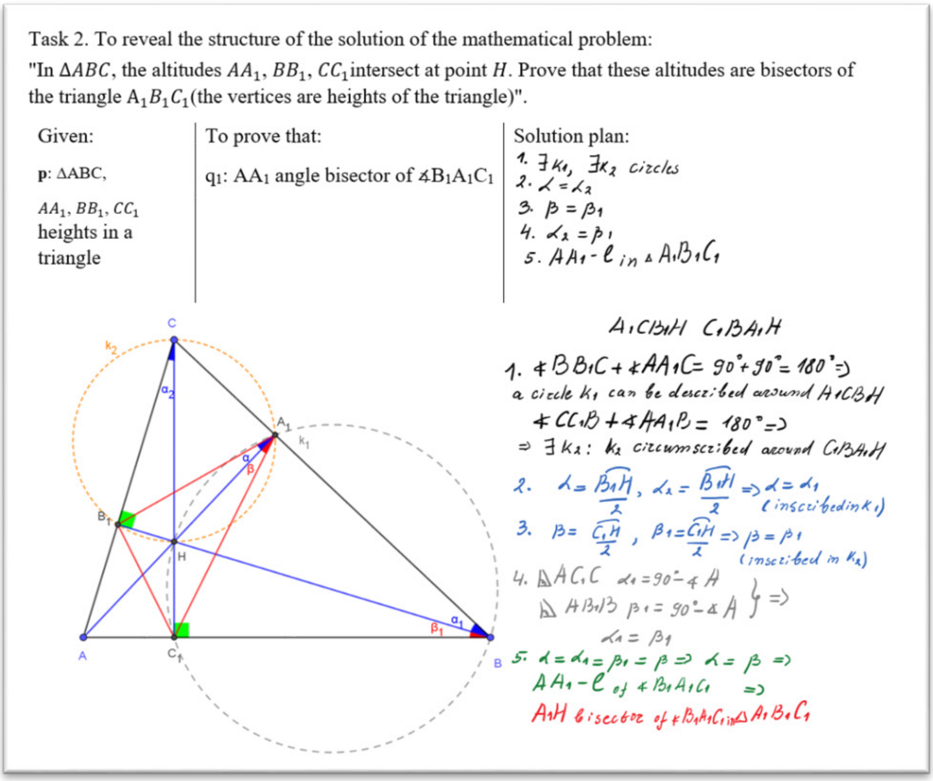


Figure 6. Co-build the solution and record with a digital graphic tablet

With this tool, the sub-steps of step 8 are as follows:

8.1. The text of a pre-recorded methodical or math task is copied to *OpenBoard*. Text can be cut with the Scissors tool from an e-textbook at the time of construction of the assignment.

8.2. A schematic model of the task is drawn up with *OpenBoard*'s drawing tools.

8.3. Methodical or mathematical work on the relevant task follows, using the tablet and the *OpenBoard* writing tool. The reasoning carried out is recorded on the sheets.

8.4. The teacher can quickly switch and show other open windows, write on them and make explanations.

A greater number of tasks can be solved in this time-saving way. The teacher shows various sources and new techniques of work that future teachers can use in their teaching practice.

Monitoring the results of the implementation of the model

The model has undergone repeated testing and continuous improvement through practical application in a pedagogical context. A comparative analysis of the results of online learning from the first year of the pandemic – the academic year 2019/2020 and the application of the model in the academic years 2020/2021, 2021/2022 and the winter semester of 2022/2023 (in the summer semester, full-time studies have been resumed). There are three criteria for evaluating the effectiveness of the conducted experiment: *Degree of development of mathematical competence*; *Level of development of digital competence*; *Degree of formation and development of pedagogical competence*.

At the beginning of each semester, in each discipline, online tests were conducted to check and evaluate the mathematical competence of the students and surveys about the digital and pedagogical competences. Statistically insignificant differences were reported between the observed groups.

At the end of each semester, the mathematical competence was assessed through an online test, and the digital and pedagogical competence were established in the methodical developments of the lessons presented online. Achievement of results is observed for each of the criteria, with the increase being more significant for digital and pedagogical competence. The presented online lessons meet to a greater extent the methodological requirements for development (Galabova, 2008). Future educators use and apply traditional methods, supplementing and enriching them with modern technologies and teaching aids.

As a result of the research, students from the "*Preschool and primary school pedagogy*" specialty. created didactic games in educational environments: *LearningApps*, *Wordwall*, *Kahoot*, puzzles from jigsawplanet.com, etc. They were able to write pieces of code in *LiveWorksheets* to create engaging interactive worksheets that students can use to immediately check the accuracy of solved problems. Colourful, engaging and above all valuable educational presentations and videos were developed.

The students studying "*Pedagogy of mathematics and informatics"* in secondary school develop the skills of drawing geometric drawings with Word's tools and dynamic drawings with GeoGebra. For the period of the study, educational presentations were developed with *PowerPoint*, *Microsoft Sway* and *Prezi* and recorded videos with *Skype*, *MS Teams*, *OBS studio*.

The formation of the mathematical, pedagogical and digital competences of the students-future teachers is also developed through learning tasks for extracurricular activity, also carried out in an online environment. Technologies tested in a number of learning activities can be summarized:

• *Solving mathematical and methodological problems* with electronic tools and mathematical educational software in theoretical and practical disciplines.

• *Development of individual and team learning projects* on didactics of mathematics; elaboration of computer lesson presentation, research and use of computer educational games, interactive worksheets and e-tests; analysis of electronic textbooks; recording with a digital camera of pedagogical objects and phenomena.

• *Internet research to enrich competences on the studied topics*: search for additional information in electronic journals and libraries (analysis e-article, writing essay, abstract, project, etc.).

• *Online class observation*: remote observation of school lessons in an online environment, video recording of the lesson, analysis of the protocol of the observed lesson, development of an electronic learning portfolio for pedagogical internship, etc.

• *Online practices and internships with electronic documents*: criteria maps for evaluating the pedagogical and methodical competence of the teacher intern; lesson plans and lesson computer presentations; educational electronic games, tests and software teaching resources.

The author's competence model for online training of the students who are studying to be teachers has been shared and applied by other professors at the University of Veliko Tarnovo. According to the method of expert evaluation, they give a positive opinion about the model and share about increasing the results in all criteria.

The conducted survey of students' satisfaction shows that they appreciate the positive influence of the model used for conducting the seminar classes. They share that continuous visualization is useful for them, they are satisfied that they learned in a short time how to use new software products to make their lessons modern, interesting and exciting. They express gratitude for recorded videos, which they also watch asynchronously depending on their individual needs.

The application of the Competence model for conducting online synchronous classes raises the level of mathematical, pedagogical and digital competence of future teachers. Competencies are developed for: analysis, synthesis, critical thinking, application of specific methods of mathematics, reflective thinking, for written and oral communication with the language of mathematics. Through teamwork, qualities such as tolerance, confidence, persistence, precision, adaptability and initiative are improved.

By applying this model, the teacher motivates and provokes the students to be active participants in their studies and self-learning.

Conclusion

The crisis in the education system (2020 – 2022) created by the COVID-19 pandemic has accelerated the process of digitalization of education and the search for innovative technologies for learning in all its degrees. The university has a responsibility to prepare highly qualified mathematics teachers ready to teach and educate students belonging to the digital generation. In addition to basic mathematical and pedagogical-methodical competence, the modern mathematics teacher must have digital competence.

The conducted three-year research confirmed the hypothesis that if innovative technologies for online synchronous learning (*Skype*, *Microsoft Teams*, *Open Broad Caster Software* and specialized mathematical software) are applied in the training of the students who are studying to be teachers of mathematics, it will increase the level of their competence.

The general conclusions of the study are:

• Today, we cannot train the students who are studying to be teachers in mathematics as we used to train them in the past with informative conversations and demonstration methods. The reasons are that once they experience the possibilities of electronic resources and learning software and applications, they show more interest in learning and show higher learning results. On the other hand, the university prepares teachers to teach school students – digital explorers who live and learn entirely in the digital world.

• Through the systematic application of the competency-based model, students not only learn its components, but also develop the ability to use it in their own teaching practice. Using different work techniques promotes flexibility and skills to deal with different situations that may arise in the classroom.

• The tested digital technologies in the *Didactics of mathematics* training prove their educational and developmental functions. The learning resources and learning videos recorded by the computer applications are very useful for learners in relation to multimodal learning (information flows through different channels and activates several senses) as well as self-learning (repetitive, self-paced learning).

• The competency model provides future teachers with the knowledge and skills needed for digital education. This holistic approach not only enhances their pedagogical competence, but also enables them to effectively engage and inspire their students in the learning process.

The proposed model for conducting online synchronous classes is suitable for both university and school education, and the teacher can specify and diversify the individual steps and experiment with other software. This flexibility allows the application of innovative approaches and practices in the teaching and learning process, which is a fundamental aspect of the competence approach.

ACKNOWLEDGEMENTS: I sincerely thank Prof. Dr. Darinka Galabova for her continuous support in my pedagogical practice and in conducting this research, for her patience, motivation and shared valuable knowledge.

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