Mathematics e-course for part-time students

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Abstract: *The development of information technologies and the improvement of both students' and lecturers' computer literacy open the possibilities to improve the methodology of teaching Mathematics and to conform to various students' needs. E-learning has already been applied for teaching Mathematics and Statistics course of first- year students at Aleksandras Stulginskis University for several years. This year it has been launched for teaching Mathematics to students of all faculties. The article analyzes the reasons for launching Mathematics course teaching through Moodle environment to AS university part-time students. What is more, it presents both advantages and disadvantages of Mathematics e-teaching. It also presents and analyzes Mathematics teaching material and methodology. Some problems have occurred in the process of creation and administration of Mathematics e-teaching. For instance, these are unfitted tools for evaluation of students' mathematical achievements, lecturers' qualms of efficiency and expedience of Mathematics teaching at a distance, students' insufficient mathematical literacy. One of the advantages is cooperation between lecturers while launching e-courses, i.e. Mathematics topics are analogous for all ASU first-year students only the scope is different, thus lecturers can share teaching material, information, etc.*

Keywords: mathematics, e-learning, Moodle, part-time students.

Introduction

Application of information technologies in teaching has already been analyzed for several decades in the scientific literature. This type of teaching and learning possibilities is now available and attractive for a bigger number of lecturers and students thanks to the improvement of information technology and the development of the Internet connection. Practically, there are no students who do not have skills or technical facilities to use the Internet or modern teaching and communication possibilities. Therefore, virtual teaching environment is successfully applied in various fields of studies. Due to changes in teaching methodology of all subjects Mathematics does not lag behind. There are lots of modern tools that could be used for teaching Mathematics. These are: educational software, video recordings, interactive whiteboards, Intranet, the Internet, etc. The presentation of mathematical symbols does not cause any problem, i.e. text editors and website design tools are suitable for this. Some of lecturers apply calculation software, such as Maple, Mathcad, etc. However, there are discussions ongoing regarding the particularity of Mathematics teaching in e-environment (Marom et al., 2003; Bilbao et al., 2004; Marshall et al., 2012; Vallner, 2012). There are constant doubts whether it is rational, effective and useful or it is just a temporary trend. As the analysis of various literary sources (Marom et al., 2003; Smith et al., 2008,) revealed, teaching Mathematics at a distance is still problematic and not very attractive for both lecturers and students. Firstly, there is a problem of feedback. It is still difficult to check whether a student has solved the task correctly and it is hard to identify where a mistake has occurred because the final result can be written in many different ways (Vallner, 2012). Furthermore, many authors emphasize that distance teaching is successful if a student has motivation for studying. However, the declining literacy can be a barrier that interrupts student's acquisition of knowledge presented in the language of Mathematics. Due to these difficulties Mathematics teaching at a distance is not very common. Nevertheless, changeable habits and skills of using various types of technologies (different to the ones that were popular 20 years ago) forces lecturers to apply information technologies in the process of teaching different subjects, not excepting Mathematics.

Materials and methods

The article is based on the analysis of scientific literature as well as the qualitative analysis of Mathematics e-courses devised at Aleksandras Stulginskis University. Teacher and student surveys have been carried out in order to evaluate the problems that occurred while establishing the e-courses.

Results and discussion

The assumption of Mathematics e-course creation

The problem of the decreasing number of students at our university is due to the complicated demographic situation as well as the ongoing educational reform in Lithuania. Therefore, in order to attract more students the teaching style should be improved and varied facilities should be proposed addressing the diverse needs of students. Our university's students mainly study specialities that are related to agriculture. Thus, possibly, they do not have expectations concerning the studies of Mathematics. Moreover, there are even more problems

regarding the part-time students who not only work but also live quite far from the university. Some of them live not only in the remote regions of Lithuania but also abroad or, for instance, they work in England, Ireland or Norway. Traditionally the studies for part-time students were organized this way: students arrive at the university for a month-length session. During this time they attend intensive lectures, account for their individual tasks and then take an examination at a stated time. During the period between the studies and examinations students are consulted once a week on Thursdays and once a month on Saturdays at the appointed time so that they could arrive and have their questions resolved. What are the problems of organizing this type of teaching and studying? Some of them are:

- Some students have difficulties arranging a month-length holiday from work twice a year;
- It is quite onerous to conceive and soak up the large amounts of information given so intensively;
- It is difficult to arrive at the consultation during the period between the studies and examinations due to the fact that a single-day arrival is inconvenient, expensive and for some of the students even impossible.

Regarding these circumstances the ideas of distance education are being implemented during the recent years. It should be noted that the implementation of the e-courses was not very active; on the contrary, it was carried out thanks to some enthusiastic lecturers. This could have happened because the course implementation encouragement systems were not attractive. The majority of lecturers tended to avoid this type of activity because it was new and required a long time studying the ways and methods of teaching innovatively. However, at the end of the previous school year the university authorities decided that the extended studies should be taught partly in a distance way, paying attention to the implementation of active learning on Moodle platform. Moreover, this should result in a shorter studying session period. Therefore, during this academic year the e-courses of all subjects that are taught to the first-year students of extended studies have been prepared and implemented on Moodle platform.

Students

Several aspects were taken into consideration while preparing Mathematics e-course for particular group of students. These were:

- The level of Mathematical literacy;
- Possibilities and skills of using information technologies;
- Possibilities and skills of studying in a distance education way.

To begin with, it should have been taken into consideration that the majority of part-time students had graduated from schools quite long ago and their Mathematical knowledge was vague. Moreover, some of them had never thought they would ever need this information. Thus the material should have been prepared so that it is easy to understand for a person who is going to renew his/her mathematical skills.

For this reason it is helpful to include not only the new material, but also references where students could find a revision of school topics. Furthermore, for more profound studying references coursebooks should be also included. As far as students' possibilities and skills of using information technologies are concerned, it should be admitted that this does not cause any problems. Currently the Internet connection in Lithuania is good enough. Moreover, there are only rare cases when students do not know how to use a computer. The service of e-mail is widely used for arranging a meeting or giving the tasks or study material. What is more, various study materials and individual tasks are put on the university's website.

However, this could be called a passive teaching, because the student gets information, but there is no active communication or cooperation and the feedback is weak. In order to encourage students to use the virtual learning environment all first-year students are introduced with Moodle system which is quite simple to grasp. If this learning environment is applied in teaching other subjects then it does not take long to acquire a habit of using it. However, there is one thing that bothers – self-discipline and motivation are needed for a successful acquisition of the subject. As the term says itself – it is an e-learning, not the e-teaching system. Thus students should put more effort into studying rather than being passive observers. Though, due to the flexible timetable when students can choose the most suitable time, some of them still have difficulties finding some time at all.

Lecturers

Many years experience has revealed that the best (and the most expensive) way of teaching is an individual teaching, i.e. when a lecturer can give an immediate consultation on student's mistakes and give advice what he/she should learn additionally. A very common and widely used way of teaching is to teach a group of students. It encompasses explanations of task solving methods done on board and during the practice lectures, as well as analyzing how it is going on and explaining the solution to a bigger group of students. It should be taken into consideration that in both cases a student is able to soak only a part of information that is given; especially if the information is given in large amounts and only through the method of explaining. As it is commonly known the acquired knowledge should be revised and students should try to apply it while solving similar tasks. Bearing this in mind the University's Mathematics lecturers are constantly preparing study material so that detailed examples (sources of information) of various ways of solving the tasks were included. Moreover, it is expected

that students would use this material for their additional studies in their free time and speed they wish. It should be noted that students can use not only the material that is prepared by lecturers of ASU, but also the e-books that are prepared by lecturers of other universities. These are available on the University's website. However, the methodological literature that could be found on the Internet is often too complicated to understand for the first-year students because of the barrier of the foreign language. Nevertheless, written sources even if they are presented online are unattractive for first-year students because they do not have the skills of reading and understanding the mathematical information. One of the ways to make learning more diverse is the creation of Virtual learning environment. Various systems could be used for this purpose. These are: Blackboard Learning System, Classroom, Moodle, blogs, Wikis etc. Carr (2000) remarks that students show more favour to those e-courses that are conducted by lecturers who are more skilful in this activity. The experience of teaching Mathematics at a distance was quite poor. Some lecturers (Rimkuvienė et al., 2010) have prepared a small extent course for students of the faculty of Agronomy. Firstly it was designed for working in Blackboard Learning System.

However, the University decided to use Moodle environment and thus the development of this course slowed down as long as lecturers mastered the new environment. Although this did not cause any significant problems, still there were some inconveniences. For instance, each question should have been reviewed and pictures should have been replaced when transferring the questions with pictures from one environment to the other. Moreover, the course presentation structure should have been reorganized, etc.

Advantages and disadvantages

It should be noted that many lecturers had sceptical attitude towards the idea of teaching Mathematics at a distance. Concerning students of engineering specialties the expediency of teaching Mathematics at a distance was most doubtful. During the initial discussions this suggestion was considered to be meaningless and it was even regarded as possibly worsening the quality of teaching. What are the reasons for such approach? Firstly, when teaching students of non-mathematical specialties lecturers face with such problems as poor mathematical literacy and insufficient motivation for studying Mathematics.

We could not agree more with the ideas of Smith G., Ferguson, (2005):

> *Online students often work full time and often have a poorer academic background. Also they are often returning to higher education after a long hiatus. They may have forgotten much of their earlier math skills. This means they often lack the requisite background skills needed for mathematics. Because mathematics is cumulative in nature, with later methods building quite rigorously on earlier methods, mathematics is particularly unforgiving on gaps in background knowledge.*

According to lecturers, when task solution is explained in a face-to-face manner it can be observed from a student's expression when a lecturer has to pause or give a further explanation on something or, for instance, go as far back as school topics. Furthermore, a lecturer can quickly check the tasks that are solved during the practice lectures and identify the character of the main mistakes made. Also, when explaining the solution to one student it can be simultaneously explained to the whole group of students. However, this does not always solve the problem because usually some students are too absorbed into their own tasks that they do not hear the explanation given by the lecturer. As far as recorded material is concerned, it is impossible to get the feedback. However, the recorded material can be watched several times or stopped any time; also it can be played at any convenient time. What is more, distance learning allows placing the answers to questions that are relevant to many students somewhere everybody could check them. When teaching how to solve mathematical tasks it is very important to not only check the final result (sometimes it can be false due to "silly" mistakes), but also the method used and whether the rearrangement was done properly. Unfortunately, e-learning systems are poorly adapted for Mathematics. On the one hand, it is rather difficult to transmit such revision to a computer. On the other hand, computer-based testing is very suitable for checking simpler tasks. Nevertheless any qualms Moodle environment started to be partially used for teaching Mathematics. The model of collaboration was chosen for creating the courses regarding the fact that some of lecturers did not have any experience in using virtual environment for teaching. This is opposed to the model where each lecturer is obliged to create his/her own course. It is obvious that the number of hours for Mathematics lectures and the topics are different for students of different specialities. However, some of the topics are the same. Thus, some parts of the material for one course can be successfully used for the other one. This is relevant when creating the question base. This activity is especially complicated methodologically, intellectually and in terms of time. Having started a large amount of e-teaching it was very beneficial that during the autumn semester Mathematics was taught to part-time students of only one faculty. Therefore, lecturers could pay more attention to identifying the mistakes and improving the course. A large part of the material was used for preparing the course for students of other faculties.

Mathematics course structure and content

According to the schedule the course material was divided into topics. Each topic includes a summary of lectures, explanations, methodological advice on task solution, tests, and individual tasks.

Theoretical material and examples of task solutions are presented in several ways:

- a summary of lectures and methodological advice on task solution – in *pdf* format;

- PowerPoint presentation;
- Video files (slides with recorded explanations; examples of task solutions).

The information that is presented in different formats is not identical. Documents, slides, video files present different examples. Explanations are delivered using various methods. For the purpose of student testing Moodle allows a variety of tools: Multiple choice, Matching, Calculated, Numerical etc. However, not all of the tools are suitable for diverse testing of student's mathematical knowledge. For instance, how could we check whether the calculation of the value of integral is correct? What is more, the tools for writing mathematical formulae on University's Moodle environment (Dragmath Editor, Math&Science by WIRIS) are not user-friendly. Therefore, in order to check students' tasks and their knowledge we use these methods:

- Students take a quiz in Moodle environment;
- Send a photo of a solved task;
- Send a file with a table of calculated answers.

The consultation method depends on the number of students. This year there was a different number of part-time students who chose to study different specialties. The Faculty of Economics and Management admitted 49 part-time students, the Faculty of Forestry and Ecology – 38 students, the Faculty of Land and Water Management – 15, the Faculty of Agricultural Engineering – 10 and the Faculty of Agronomy admitted 25 students. It is obvious that different teaching methods should be applied for a different number of students enrolled in the course. It is possible to work individually with every student if the group is small. However, if the group is big the same method of communication requires more human and time resources. If the number of students is not big then it is possible to communicate more closely and consultations can be organized more often and more careful. If the group is bigger discussions should be encouraged, questions should be generalized and published in the forum.

Consultations were organised in several ways:

If the group was small it was agreed that the lecturer would consult the students once a week via Skype. This way was not acceptable for everybody. There were 5 students who registered for a consultation and it was quite active. The consultations were held both orally and in other ways, i.e. sending messages and files. Other students used to e-mail files that were checked by lecturers and then sent back to students.

Moreover the task hand-in terms and student stimulation methods should be carefully thought over when planning the presentation of a course. This is quite challenging bearing in mind that this course will be used by part-time students who have full-time jobs and have many personal duties.

What is more, time structure in the autumn semester was not very rational. The time period between the sessions was too short to master all the material that was planned according to the program. At the beginning students' performance was quite active. However, later it slowed and even stopped for several weeks and reactivated only just before the beginning of the new session. This was taken into consideration when planning the spring session course. Certain terms were fixed not only for on-line assignments, but also exact dates were appointed for students to arrive at the university and present their midterm tasks.

Conclusion

Although teaching Mathematics through Moodle environment is still complicated and problematic the present demographic and economic situation makes it essential to create Mathematics e-courses with the help of contemporary developing information technologies. Nowadays first-year students do not face big problems using information technologies in study process. However, the lack of mathematical literacy makes it difficult to study Mathematics. Therefore, there is a great need for a constant consequent help during the whole course. Moreover, due to the need of innovative teaching methods and different style of teaching through new teaching environment, lecturers who create e-courses also need help from experienced specialists.

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