Methodical Recommendations for the Development of Online Course Structure and Content

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Keywords: Online-Course, Methodical Recommendations, Content, Educational Materials.

Abstract: The article looks into the matter of developing methodical recommendations for the structure and content of online courses. The research is dedicated to the analysis of peculiarities of developing the content of online systems and developing methodical recommendations for educational materials of online courses. The research considers the experts' experience in preparing, structuring, and developing the content of online courses and answers to the volunteers who have agreed to test the educational materials of the course "Methods for Teaching Mathematics to Students in Technical Universities" http://formathematics.com/courses/imt/mnmtzvo-en/. The participants' responses have allowed evaluating the quality of the developed course and detecting its insignificant drawbacks. The article discusses general requirements for the structure and content of the online course, means for the implementation of a testing subsystem, peculiarities of developing educational video content and educational materials in PDF format, issues of implementing forum and survey subsystems, as well as means of assessing learning outcomes. We have grounds to conclude that the quality of the course is determined by the range of factors, among which we point out the course organization based on weekly planning, implementation of a testing subsystem under conditions of extended functionality, creation of abilities to organize feedback.

1 INTRODUCTION

1.1 Problem Statement and Its Topicality Substantiation

The emergence of available web-technologies has dramatically changed the approaches to communication and education. The access to the Internet and the variety of gadgets that allow this access led to the demand for educational services that adapt to the needs of learning during life ensuring the personalization of the learning process. Such demand en-

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couraged the creation of the educational trend – the development of open educational online-platforms. The implementation of the idea of open online education requires the development of recommendations both as technical and methodical support of online courses. Thanks to them a considerable number of people can increase their qualification or develop professional expertise. Supporting the idea of accessible educational opportunities, we have studied experts' experience in preparing educational materials. By implementing numerous recommendations concerning the preparation, structuring, and development of the content for online courses, Writing and Structuring Online Learning Materials (Leicester Learning Institute, 2019), DIGICOMP (DIGICOMP, 2015) and Leicester Learning Institute (Leicester Learning Institute, 2020) remind us that we live a life of constant changes and these changes have to influence teaching and learning. To implement these changes in the system of online education, we have to provide educational materials that meet students' expectations. This means that giving learners the possibility to acquire some particular skills via online courses requires serious training. Therefore, the topicality of the issue to develop methodical recommendations for the structure and content of online courses is not questionable.

1.2 Literature Review

To determine recommendations for developing an online course, we have studied practical recommendations by FAO (FAO, 2021) who considers that the development of any course has to encourage the creation of practitioners' community and support their willingness to cooperate. While planning the development of the materials necessary for the implementation of particular types of work we paid our attention to the possibility to plan the achievement of educational progress. At the stage of planning the aims, we were focused on the concept of the platform "Higher School Mathematics Teacher" (formathematics.com, 2021), developed by Vlasenko et al. (Vlasenko et al., 2019a). Taking into account scientists' opinion while preparing the curriculum we were focused on the achievable goals, believing that the students' achievement of aims regularly will encourage their motivation to aspire to more. While developing the lectures we were interested in the researches conducted by Dommeyer et al. (Dommeyer et al., 2004), Deming et al. (Deming et al., 2015), Bauer (Bauer, 2019), who describe in their works the improvement of lecture materials using the survey of the respondents who work with courses. Cruse (Cruse, 2019), Suduc et al. (Suduc et al., 2010), Suduc et al. (Suduc et al., 2012)

recommend giving video lectures. Confirming the efficiency of using videos in the educational process, among the greatest advantages of its use the scientists emphasize the possibility of course participants to learn the material according to their pace of assimilating the educational materials. Moreover, in scientists' works, there is evidence that video content ensures a greater emotional impact on participants in comparison to the text-based one. Developing tests that according to Suwatthipong et al. (Suwatthipong et al., 2015) have to accompany learning theoretical materials we considered scientists' opinion that testing should both help to assess the progress level while assimilating the educational material and help to acquire new knowledge. Being acquainted with the research in which Wrigley et al. (Wrigley et al., 2018) compared the content quality of Massive Open Online Courses, we concluded that while developing course materials it is necessary to evenly distribute labor intensity of students' learning activities by weeks, providing the interaction among the participants. Furthermore, we took into consideration the results of the research by Jönsson (Jönsson, 2005), Vlasenko et al. (Vlasenko et al., 2020e), where it is justified that the efficient online course includes the integration of various web tools (Vlasenko et al., 2020e) and resources for learning the course material.

Thus, giving recommendations for the presentation of educational materials during online courses, every scientist stated that there should be a specific approach for the development and certain nuances should be considered. So, the article is aimed at carrying out a theoretical analysis of peculiarities of the existing online systems and the development of methodological recommendations for the development of structure and content of online courses on the platform "Higher School Mathematics Teacher" (formathematics.com, 2021).

2 METHOD

The analysis of the content on open educational platforms, the world experience of implementing online learning, the synthesis of the results after such an analysis, and our own experience allowed forming methodological recommendations for the preparation of online courses.

We have surveyed master students (the qualification code of the program "014.04. Secondary Education. Mathematics") and higher school mathematics teachers to find out the quality of educational materials for the online course "Methods for Teaching Mathematics to Students in Technical Univer-

sities", published on the platform "Higher School Mathematics Teacher" (Lovianova et al., 2021). The theoretical analysis of the researches and resources that implement the recommendations, content structuring and development of online courses, analysis of respondents' answers to the survey questions published on the platform forum has influenced the description of the methodical recommendations for the structure and content of online courses. To explore the resources, we analyzed the structure and content of the most popular Massive Open Online Courses (MOOC). When selecting resources, we focused on the online courses (LinkedIn, 2019; Udemy, 2019; Coursera, 2019; EdX, 2019; FutureLearn, 2019) included in the Top Tools for Learning 2019 (Centre for Learning & Performance Technologies, 2021).

Having analyzed the resources, we found several sections that the online courses include and the average course duration. We were eager to know how often titles are offered and what the purpose of testing in courses is. We have highlighted the peculiarities of video lectures, training materials in PDF format. Particular attention was paid to the organization of the course process and feedback from students. Through content analysis, we have developed methodological recommendations for the development of structure and content of online courses on the platform "Higher School Mathematics Teacher" (formathematics.com, 2021).

2.1 The Presentation of the Course Taking into Account the Peculiarities of an Online Presentation

At the beginning of education on open online platforms, the user should clearly understand how they will learn and what material they will work with.

Following the recommendations of dividing online course content into sections, subsections (topics), pages, and components (Vlasenko et al., 2020d), we concluded that the construction of an online course should be based on weekly planning, where sections are formed on the principle of combining materials that are learned during one or several weeks.

We have also considered that educational methodical online courses have to include no more than 6 sections. Every section has to include one or more pages; the page has no more than one component. For instance, the online course "Methods for Teaching Mathematics to Students in Technical Universities", published on the platform "Higher School Mathematics Teacher" (Lovianova et al., 2021), includes

three sections with three topics for each one. At the same time, the course "Project Method in Teaching Higher Mathematics" (Kondratieva et al., 2019) includes 6 sections with 2 topics for each (figure 1), and the course "Personal E-learning Environment of the Maths Teacher" (Vlasenko et al., 2019b) has 5 sections with 2 topics for each (figure 2).

The number of sections and topics depends on the course volume and the preliminary survey of teachers and students (course users) who help to determine the course structure.

2.2 Structuring

Before creating the course it is necessary to have a clear understanding of the course's target audience, main needs, and peculiarities of this audience. So, tutors have to determine the aims of learning and anticipated results, subject, structure, assessment criteria, and organization of feedback. It significantly influences the content and structure of the course. Moreover, it is necessary to consider when and how the course users will learn. Also, it should be considered how often it is needed to update the learning material, how much time the tutor will spend on the organization of education and feedback. If there has to be a significant number of users, it is necessary to think about the automatization of these processes.

The structure of the course should be logical, clear, intuitively understandable. While creating the course the following points should be considered:

1) the learning material of the course has to be divided into logical sections, or according to the topics (figure 3), or of a particular length to learn it during 1-2 hours (typical learning class);

2) the headings of sections, topics, and subtopics should be well formulated, it will help users to plan which sections they will work over at every class, and will allow them to skip topics that they already know;

3) before providing the material for every new topic or section it is necessary to give a review of the coming material, its structure, results of learning, and approximate time of learning, it is relevant to give such material in form of a short video;

4) pretesting or final testing after learning a particular topic or section can be conducted on request.

The first three recommendations were considered during the development of all the courses of the platform (formathematics.com, 2021). The online course "Methods for Teaching Mathematics to Students in Technical Universities" (Lovianova et al., 2021) includes both the pretesting on Higher Mathematics and

Figure 1: Structure of the course "Project Method in Teaching Higher Mathematics".

the final course testing. Pretesting is included in the course as it is impossible to succeed during the test without learning the corresponding sections of Higher Mathematics.

2.3 Features of Writing

The educational materials should be taught in an accessible and clear form. Taking into account the peculiarities of perceiving the electronic information (Kondratieva et al., 2019), the material that will be posted in the electronic format should be 50% shorter than the analog, printed one. Therefore, more tables, schemes, corresponding examples, and researches on a particular subject should be used. Additional material should be given as a hyperlink or a separate document.

Besides, it is necessary to explain every new definition or term. It can be a context tooltip, footnote, hyperlink, etc. Also, it is relevant to create a separate glossary for every section or topic.

To give the main theoretical information on the topics during the online course, we use educational materials in PDF format that ensures compatibility and absence of distortions in published materials of the course. Moreover, using PDF format allows the participants to download educational materials to their proper computers for a further acquaintance without any preview on the web-page (Panchenko et al., 2020).

While creating educational materials in PDF format it's necessary to follow the requirements for presenting documents: to use headings, lists, images with sighs, to represent table data in the form of tables. To type text material the direct (regular) font, which ensures easier perception of information, should mainly be used. The main text should be aligned to the page width. It is not recommended to use formatting with the help of indent and tabulation, multi-column page making, blank line. While using hyperlinks it is necessary to consider that all hyperlinks should be represented as a text in the sentence to increase readability.

For instance, the course "Differential Equations" (Sitak, 2018) widely uses hyperlinks and popup notes
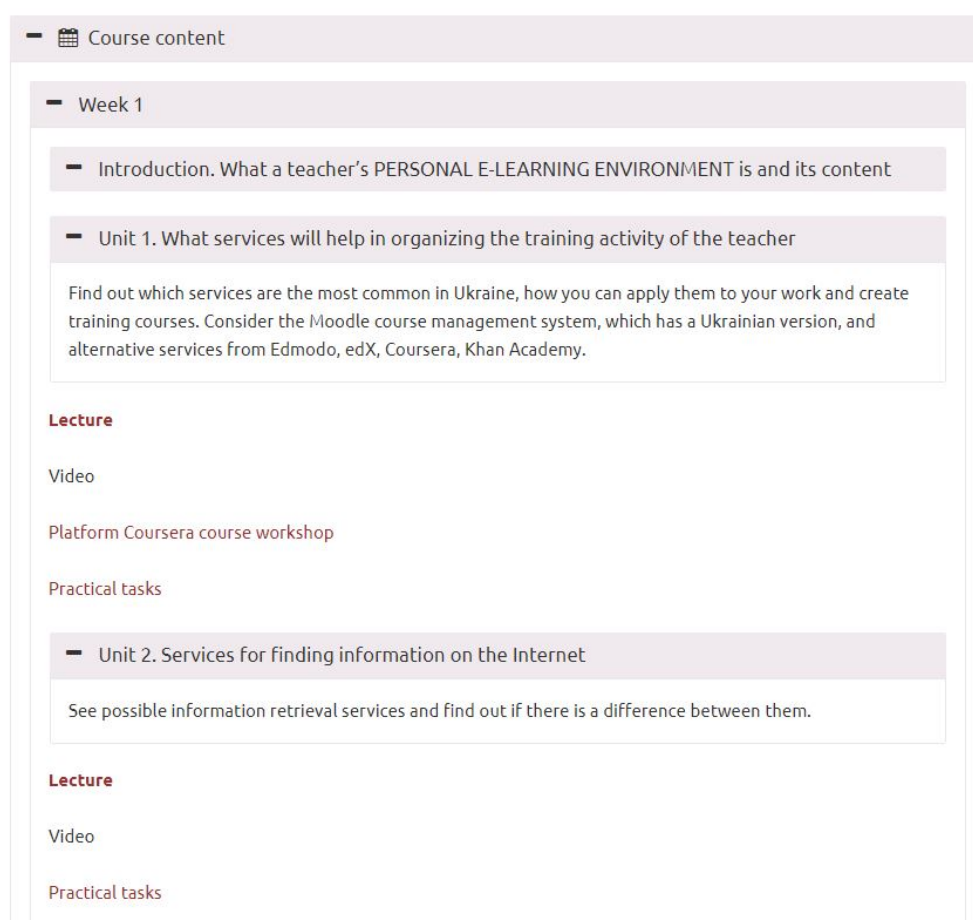
Figure 2: Structure of the course "Personal E-learning Environment of the Maths Teacher".

(figure 4), while the course "Operations Research-Oriented to Cloud Computing in the System CoCalc" (Bobyliev et al., 2020) offers smaller documents in PDF-format that can be downloaded by students for further use.

2.4 Bright Presentation of Material

To attract attention to online courses and support students' interest it is relevant to use all the possible means of material delivery – animation, video, multi-colored unusual fonts, footnotes, popup tooltips. The relevance of using the side framework to add information is proven.

If it is necessary to publish a considerable amount of educational material directly on the page of the online course, it should be "divided" into parts following the screen size, the navigation and hyperlink system should be organized and an additional PDF-version to store and print the learning material should be created.

The necessity to do group tasks, analyze and assess other course participants' work adds up to the

users' interest and will encourage the regular analysis of the learning material and periodical review. While giving the material it is relevant to repeat the key concepts, ideas, and theories several times in different forms (if it is possible).

According to the recommendations, materials of the online courses "Project Method in Teaching Higher Mathematics" (Vlasenko et al., 2020c), "Personal E-learning Environment of the Maths Teacher" (Vlasenko et al., 2020a), "Methods for Teaching Mathematics to Students in Technical Universities" (Lovianova et al., 2021), published on the platform "Higher School Mathematics Teacher" (formathematics.com, 2021) are given using video files, hypertext, demonstrative animation, audio lectures, video lectures, schemes, images, graphics, tables, drawings, information reference material (figure 5). Also, presentations and other extra materials such as attached files and interactive supplements, sources that are given in the reference list, are used.

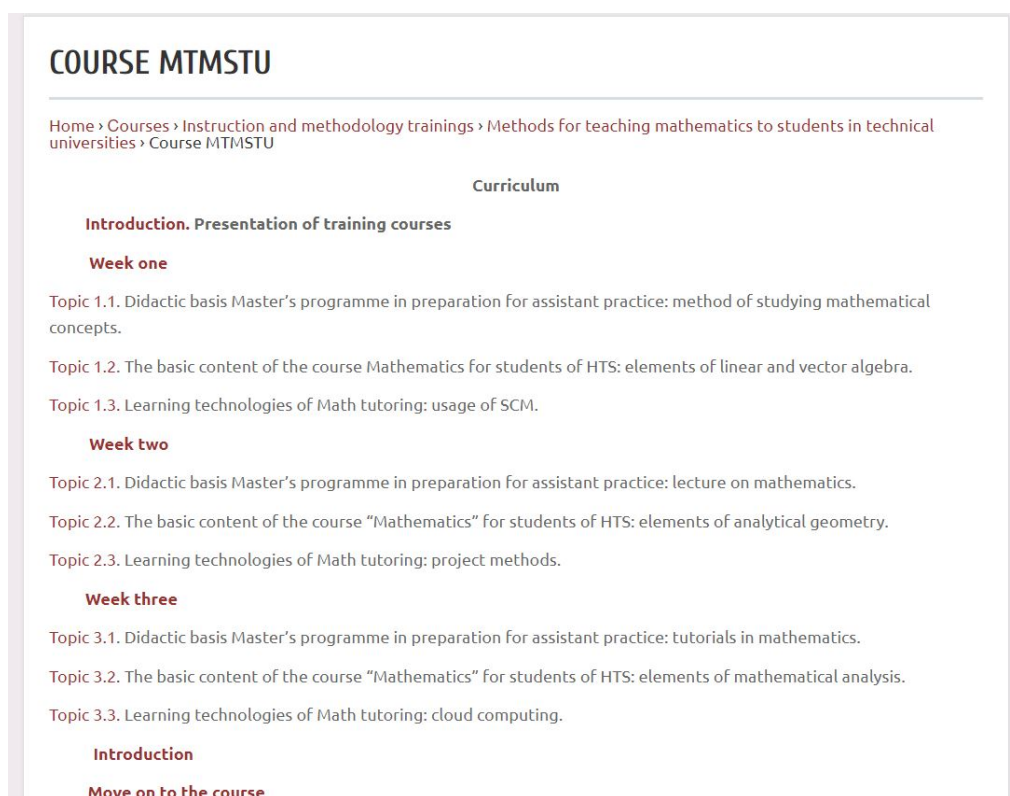We use video content to get participants acquainted with the aims and resources of the course

COURSE MTMSTU

Home › Courses › Instruction and methodology trainings › Methods for teaching mathematics to students in technical universities › Course MTMSTU

Curriculum

Introduction. Presentation of training courses

Week one

Topic 1.1. Didactic basis Master's programme in preparation for assistant practice: method of studying mathematical concepts.

Topic 1.2. The basic content of the course Mathematics for students of HTS: elements of linear and vector algebra.

Topic 1.3. Learning technologies of Math tutoring: usage of SCM.

Week two

Topic 2.1. Didactic basis Master's programme in preparation for assistant practice: lecture on mathematics.

Topic 2.2. The basic content of the course "Mathematics" for students of HTS: elements of analytical geometry.

Topic 2.3. Learning technologies of Math tutoring: project methods.

Week three

Topic 3.1. Didactic basis Master's programme in preparation for assistant practice: tutorials in mathematics.

Topic 3.2. The basic content of the course "Mathematics" for students of HTS: elements of mathematical analysis.

Topic 3.3. Learning technologies of Math tutoring: cloud computing.

Introduction

Move on to the course

Figure 3: Sections of the course "Methods for Teaching Mathematics to Students in Technical Universities".

as well as highlight particular topics. Video lectures focus on the main moments of learning material, disclose the topic of the material, and summarize the main conclusions. While creating video lectures it is expected to highlight semantic blocks (video clips) lasting from 3 to 10 minutes that will be watched by the participants during the online course. The image should be high-quality, the text that is demonstrated on the slides should be available for reading from the mobile device screen. Pure sound requires minimal background noise, clear pronunciation of words, and a stable level of volume. While creating video lectures it is preferable to use the universal format of video files MP4.

To create videos during the online course "Methods for Teaching Mathematics to Students in Technical Universities" (Lovianova et al., 2021), we used software Camtasia which implements capturing the video from the screen. Among the main functional abilities of this video editor, which is used while developing educational video, we can highlight providing the recording of the image from the screen including recording sound effects from the microphone or speakers and editing a new video without installing additional software.

To publish video content on the pages of the online course, we used the video from the file directly on the administrator's panel of the electronic platform without involving extra services. Using such a method of integration ensures the possibility to control the size of the video player and to add extra settings.

2.5 Organization of the Learning Outcome Assessment

While developing the course special attention is paid to the creation of a system to assess the learning results. It can be a constant assessment such as tests and or completing control tasks with saved results (such a system encourages the constant interest in the course completion). It is possible to use the final test on the formed competencies such as certified testing or qualified work. Let's mention that such an assessment method requires special students' motivation for test completion.

The course developer has to indicate how much time they need to check the tasks if there were given, when, and how the student can get a certificate or another learning result.

For example, in order to implement the testing subsystem on the platform "Higher School Mathematics Teacher" (formathematics.com, 2021) a pro-

Test 3.1.2

Question **2** to **5**

From the given systems of differential equations, choose the ones that belong to the normal ones.

○

$$\begin{cases} \dfrac{dy_1}{dx} = y_1 + 2y_2, \\ \dfrac{dy_2}{dx} = 3y_1 - y_2. \end{cases}$$

●

$$\begin{cases} t\,dx + (x - t\sin t)\,dt = x, \\ dx + dt = 0. \end{cases}$$

○

$$\begin{cases} y_1'' - 8y' + 16y_2 = e^{4x}, \end{cases}$$

Hint

From the given systems of differential equations, choose the ones that belong to the normal ones.

`Hint`   `Verify`

Figure 4: Popup notes in the course "Differential Equations".

gram application for extending functionality was used – the plugin "WP-Pro-Quiz" that ensures flexible settings of the responses options and provides related information.

While creating test questions it is stipulated that information about the number of points for the right answer is provided and the type of answer (single choice, multiple-choice, open choice, etc.) is indicated. Also, there is a possibility to add hints to a particular question. After creating and setting up the test it is possible to publish it on any page of the online course using special shortcodes.

For instance, for the online course "Differential Equations" (Sitak, 2018), the test is considered passed in case of giving 60% of the right answers by the participant. After the test, the participant can look through the number of right answers and time spent on taking it.

An important element while developing an online course is using surveys that enable the teacher to ask participants questions and offer a wide range of possible answers. While creating a survey the teacher describes a certain situation and formulates a question encouraging participants to express their opinion.

The final result of the survey is the percentage of the participants who chose one or another response.
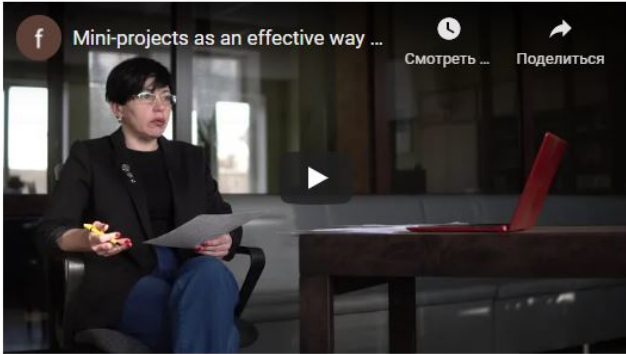
During the course "Methods for teaching mathematics to students in technical universities" (Lovianova et al., 2021), "Personal E-learning Environment of the Maths Teacher" (Vlasenko et al., 2019b), "Creative Thinking Through Learning Elementary Maths" (Achkan et al., 2020), etc. surveys are created with the help of the service Google Forms and are used as voting for theme selection as well as for discussion over course materials (figure 6, figure 7).

The choice of Google Forms as a tool for creating surveys is explained by the following characteristics: availability of the created survey for the respondents just after its publication, possibility to edit it, opening for getting answers, and closing after finishing the survey. Furthermore, there is a possibility to integrate forms for surveys on the online course page. In order to show the survey results the service generates automatically the electronic table, there is an option to review respondents' answers in the form of diagrams and graphics with statistical information in high-quality and percentage format.

In the course "Differential equations" (Sitak,

Figure 5: Online course "Project Method in Teaching Higher Mathematics".

2018) we use the system of tests with the educational aim, not the knowledge control aim. Students can pass tests several times and get instructions for the right answer. Within the course "Methods for Teaching Mathematics to Students in Technical Universities" (Lovianova et al., 2021), we assume to have peer assessment to estimate the performance of training activities. While using such type of evaluation, we followed the recommendations for the development of the criteria table. We took into account the requirements for tasks to be clearly defined and encourage the author (later reviewer) to pay attention to different sides of work. The process of writing a piece of work that corresponds to the requirements and the process of checking such works is useful for participants, as it develops skills of giving constructive criticism including negative.

For every task, the course tutor developed the evaluation criteria with a detailed description of the necessary content on every criterion to get a particular mark. As a tool we offer to use Google Drive services to complete the task; it ensures the possibility to store completed works by implementing shared access to the documents and Google Forms to implement the feedback with participants.

Successful learning of the educational material of the course is completed by getting a certificate. The criteria of getting a certificate are based on criteria-oriented approach that includes the comparison of educational achievements of every participant with planned learning outcomes.

2.6 Feedback Organization

The feedback organization is important both for the course developers and course participants. The necessity to ask questions and receive responses, discuss the issue, express recommendations for the course arises during any education.

The feedback can be organized for every course

Figure 6: Online course "Methods for teaching mathematics to students in technical universities".

Figure 7: Online course "Creative Thinking Through Learning Elementary Maths".

separately and the whole online platform. It can be a discussion page, chat, or forum. It is important to organize the prompt course tutors' notification about new questions and messages. Usually, it is necessary to indicate them in the settings of the corresponding page/forum. Such an option allows reacting promptly to the incoming messages.

For example, during the course "Methods for Teaching Mathematics to Students in Technical Universities" (Lovianova et al., 2021), "Personal E-learning Environment of the Maths Teacher" (Vlasenko et al., 2019b), "Operations Research-Oriented to Cloud Computing in the System CoCalc" (Vlasenko et al., 2020b), the feedback with course participants is organized using thematic forums (figure 8). Participants' part in the weekly forum gives them a possibility to express their proper opinion using discussion questions that concern the main topics of the course.

Together with the forum use the organization of participants' communication takes place in asynchronous mode, in other words during a long period. Participants can sign up for the forum to get notifications about new topics and answers on the forum. With the help of the forum, there is a participants' discussion of their classmates' works, which is outlined

by one of the course tasks. Furthermore, participants can use the forum to share examples of their work and to ask each other questions and the teacher about the studied topics.

The forum implementation on the platform "Higher School Mathematics Teacher" (formathematics.com, 2021) was carried out using the plugin "wp-Foro" which consists of a set of the main tools for managing the forum. The main advantages of using the plugin are flexible settings of the forum presentation, the creation of a convenient user's profile, and the possibility to add particular supplements to extend the functionality.

Besides the forum, teamwork with shared documents and emails is used for the organization of feedback during all the courses.

2.7 Editing and Checking

It is important to remember that any material that the course developers give students reflects the scientist's qualities or the educational institution that is the owner of the corresponding open educational online platform. Thus, all the materials for distance education have to be checked in advance. It is relevant to
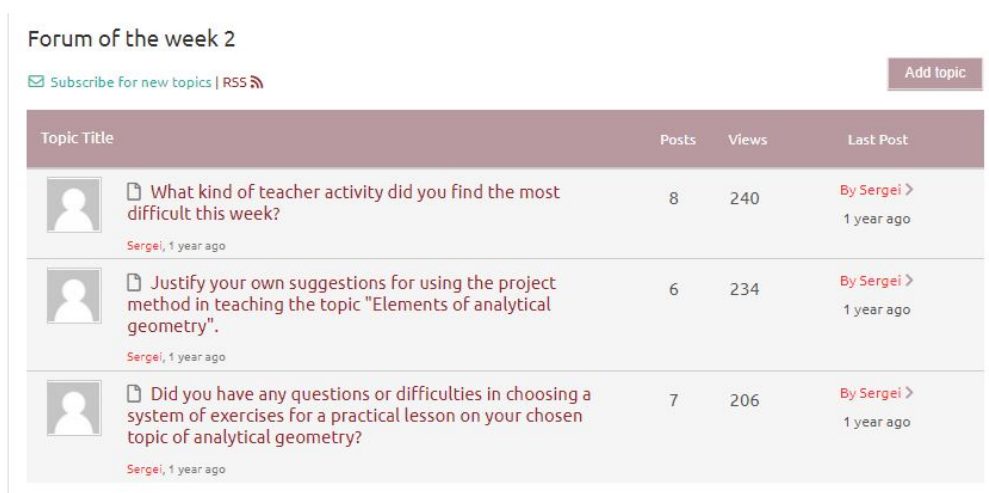
Figure 8: Thematic forum in the course "Methods for Teaching Mathematics to Students in Technical Universities".

carry out the approbation of the educational course as a pilot project with discussions on the teachers' forum and further consideration of remarks and recommendations. Also, an outside review of educational materials by several users with a different level of training can be used. Reviewers must be developers' colleagues, specialists of the corresponding area, linguists, and non trained specialists.

Before publishing the materials it is necessary to print them and check again. Special attention should be paid to the observance of copyright, it is important to make sure that all the borrowed materials have authors and references.

It is relevant to develop the course not only in the official language but in English too so that it allows increasing the audience of the educational platform significantly.

2.8 Responsiveness

Most users study the course using their phones or tablets. Therefore, it is important to keep this fact in mind in the process of course development. Responsiveness reflects the quality and aesthetics of the system display on mobile devices that have different resolution. To ensure the responsiveness of the course design, it is advisable to use methods of presenting the interface using CSS stylization for individual device resolutions.

It is important to keep in mind that the menu interface and sidebar elements look different on different mobile devices. For a better perception of the course, the developers will need to adapt the size of text, headings and subheadings, links, buttons, image sizes, and other interface elements. Thus, in figures 9-10 we can compare the look of the course page "Per-

sonal E-learning Environment of the Maths Teacher" on a desktop computer and a smartphone.

3 RESULTS

To analyze the correspondence level of the content during the course "Methods for Teaching Mathematics to Students in Technical Universities" (Lovianova et al., 2021) to specified recommendations of developing online courses, we held a survey among the participants. Respondents were offered to answer the survey questions using the forum on the platform "Higher School Mathematics Teacher" (formathematics.com, 2021).

68 volunteers who agreed to test the educational materials of the course took part in the survey. Participants' answers allowed evaluating the quality of the developed course and determining minor gaps in the implementation.

We offered them to range the quality of presenting information concerning the structure and semantic content of the online course on a scale from 1 to 5 where 1 is the minimal parameter estimate, 5 is the maximal one. Table 1 provides the survey results.

The ranking results are presented in the form of a histogram (figure 11).

Analyzing the histogram data we concluded that most volunteers have highly evaluated the structure and quality of the developed content of online courses giving 4 or 5 points. In respondents' opinion presenting information concerning the course program, its duration, and frequency of classes were fulfilled most successfully. Among the types of educational content materials in PDF format and video lectures got the

Figure 9: Desktop version of the course "Personal E-learning Environment of the Maths Teacher".

Table 1: Results of testing educational materials of the course "Methods for Teaching Mathematics to Students in Technical Universities".

Questions	Respondents' answers				
	1	2	3	4	5
Accessibility of information presentation concerning the aims and purposes of the course	5	8	10	27	18
Accessibility of information presentation concerning the duration and frequency of the course	3	4	13	23	25
Accessibility of information presentation concerning the target audience of the course	6	3	11	28	20
Accessibility of information presentation concerning the course program	1	6	9	25	27
Convenience of the navigation system during the course	8	9	15	24	12
Quality of presenting educational materials as video lectures	1	4	7	29	27
Quality of presenting educational materials in PDF format	2	6	12	23	25
Quality of tests	3	5	14	26	20
Quality of survey implementation among course participants	4	7	16	21	20
Quality of peer-assessment implementation	4	8	14	20	22
Quality of feedback implementation using the weekly forum	5	8	18	19	18

biggest number of maximal points. So, the presentation of the online course structure and the quality of developed educational materials correspond to the given recommendations.

Moreover, participants were offered to evaluate the general impression from the online course "Methods for Teaching Mathematics to Students in Technical Universities" (Lovianova et al., 2021) (figure 12).

According to the survey results, 68% of respondents believe that the course is developed at a high level, 25% have estimated the course development at a sufficient level and 7% marked that the course requires further development. Among the recommendations given by the respondents concerning the improvement of the online course, we can note the idea of including the final test to evaluate the results of
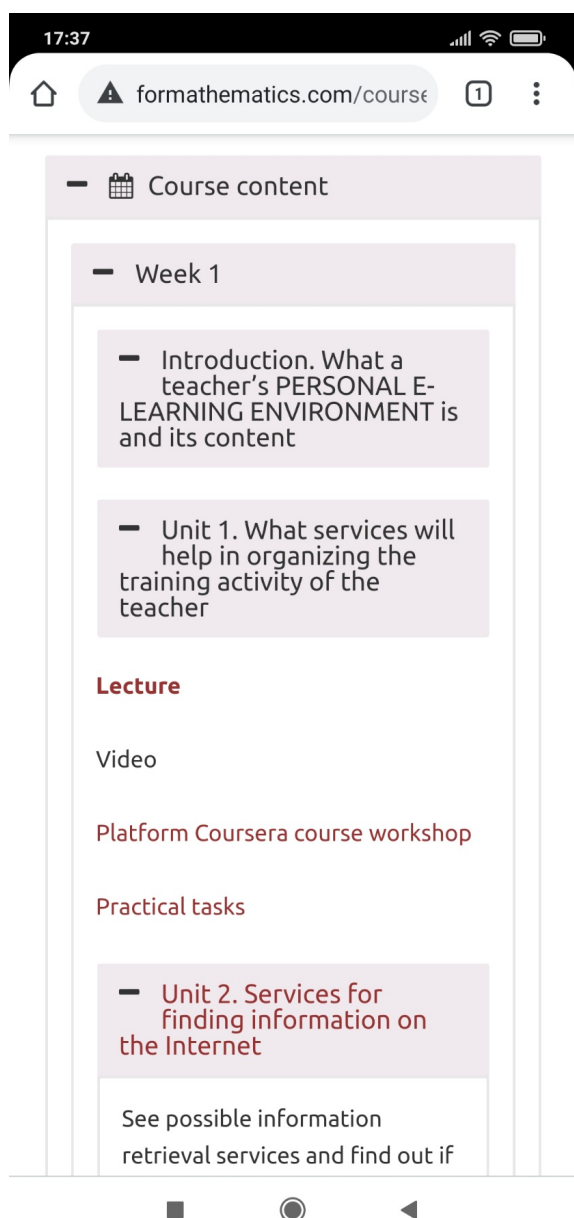
Figure 10: Mobile version of the course "Personal E-learning Environment of the Maths Teacher".

learning activities and modernization of the navigation system for the course program.

4 DISCUSSION

The analysis of the research by Cuesta (Cuesta, 2010), McGahan et al. (McGahan et al., 2015) and work experience of APass Educational Group, LLC (APass Educational Group, LLC, 2019) developing online courses have confirmed our point of view about the influence of the quality of developing materials for online courses on motivation and success during the course. We agree with the point of view given by Cuesta (Cuesta, 2010) who emphasizes the necessity of constant analysis and evaluation of such parameters as the formation of learning content, interaction among course participants. We support the conclusions given by McGahan et al. (McGahan et al., 2015) about the importance of developing methodical requirements for the content of online courses as the main tool of its quality evaluation. The recommendations provided by the APass Educational Group, LLC (APass Educational Group, LLC, 2019) are very important for our research; they offer to provide the efficiency of the educational aim of the course using the following means: clear purpose presentation; correspondence of the aim to the students' expectations; direct responsibility between educational aims and students' actions during the course and their evaluation; learning materials selection and technologies that correspond to the educational aims, student's motivation and support of their progress; content accessibility for all the students.

We got acquainted with the accomplishments of Scagnoli et al. (Scagnoli et al., 2019), Morrison (Morrison, 2017), Puzziferro and Shelton (Puzziferro and Shelton, 2019) when we started developing video lectures. These works are dedicated to the research of students' opinions on the use of video lectures in online classes. So, during the development of video lectures, we were focused on the scientists' recommendations. These recommendations were the following: to consider students' needs; to plan thoroughly and integrate into a balanced way video lectures with other course materials; to use multimodal information delivery; to create a sense of cooperation with the content through students' control over the media and teachers' presence.

The acquaintance with students' evaluation via Camtasia (Quora, 2019) as one of the most available programs of editing and creating video has proved the relevance of the choice of this program for presenting course content. Screen recording with necessary effects helped us to create a high-quality new presentation and documents in PDF format. The involvement of such a type of material was approved by the forum participants. During the course presentation and every week, we encourage students to take an active part in forums. This approach corresponds to the conclusions given by Martín-Blas and Serrano-Fernández (Martín-Blas and Serrano-Fernández, 2009), who prove that participants who take an active part in forum discussions tend to get higher marks and show a higher level of learning edu-
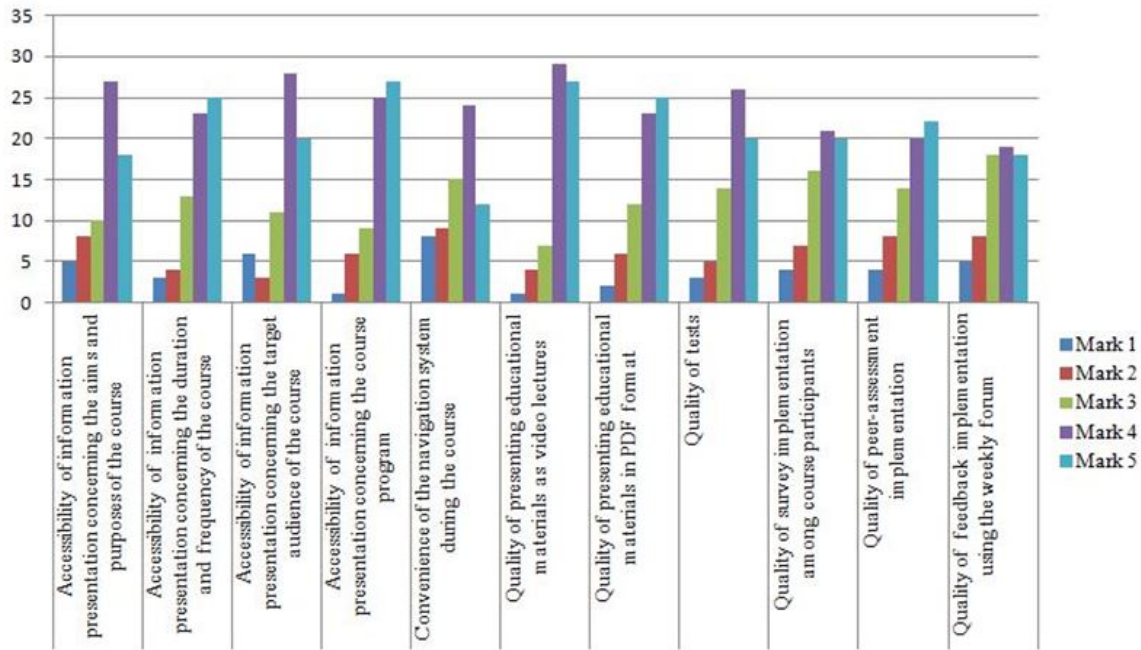
Figure 11: Results of testing educational materials of the course "Methods for Teaching Mathematics to Students in Technical Universities".
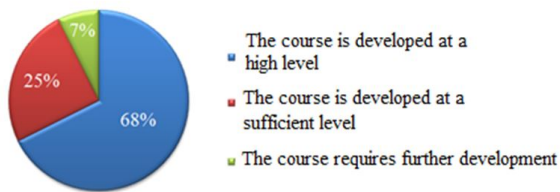

Figure 12: The general impression from the online course "Methods for Teaching Mathematics to Students in Technical Universities".

cational material in comparison to those who did not use the forum.

5 CONCLUSIONS

The relevance of the matter to develop methodical recommendations for the structure and content of online courses arises from the fact that the quality of education using online courses depends on the quality of content development. Educational materials have to be interesting, correspond to students' expectations, and encourage motivation during the course. The content development requires thorough planning and balanced integration with other course materials. Testing during the course should have both controlling and educational functions. The creation of course content should be accompanied by the evaluation of students who help to assess the quality of the developed educational materials and detect gaps.

Based on the analysis of current recommendations regarding the development of online courses, as well as considering the results of students' and teachers' surveys we have described the methodical recommendations for the structure and content of online courses. The course is based on weekly planning, the test subsystem is implemented under extended functionality, and abilities to organize feedback are integrated. While planning online courses it is necessary to plan properly and organize feedback with course participants. The feedback allows detecting both positive aspects and gaps, drawbacks that were detected during project planning and implementation.

The possible way of implementing feedback is the creation of several thematic forums where information exchange among the participants is possible.

The results enable to define several directions for further research, among which the implementation of online resource usability.

ACKNOWLEDGEMENTS

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