

# Differentiated System for Digital Professional Development of University Teachers

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**Abstract:** The article highlights the issues of designing a system for teacher digital competence development. The paper describes the research that resulted in the development and implementation of a differentiated system for digital professional development of university teachers at the Borys Grinchenko Kyiv University. The principle of system differentiation is realized in two directions: to time possibilities of testing and minicourse passing; to needs of teachers according to professional direction and disciplines taught. A model of organization of this system based on self-assessment, self-education and micro-teaching principles has been developed. The main structural elements of the differentiated system are a diagnostic test and sets of mini courses. The approaches to the formation of the diagnostic test, including ensuring its integration, variability and validity, as well as the principle of its use in order to establish the level of digital competence of teachers in accordance with the developed corporate standard of digital competence were applied in detail. The content of the levels is analyzed on the example of the levels Analyst-Researcher (A), Integrator (B1) and Expert (B2). For the levels Leader (C1) and Innovator (C2) the structure based on the formative assessment process is offered. The system allows teachers to build their own professional development trajectory as a digital footprint reflected in a personal study, and the use of embedded business intelligence tools provides a visualized holistic picture of digital professional performance.

## 1 INTRODUCTION

The objectively necessary mass transition to e-learning during the quarantine and martial law periods has become a global challenge for the whole educational environment of Ukraine, including higher education institutions and teachers in particular.

An important issue is the quality of e-learning, as noted, for example, in the 2021 EDUCAUSE Horizon Report (Pelletier et al., 2021). This focuses specifically on the quality of online learning as a technology, the use of analytics, open resources, a mix of blended and hybrid learning models. At the same time, the requirements for information and digital competence, which is the basis for effective use of digital tools for online learning arrangement, are increasing.

For this reason, the issue of implementing an ef-

fective professional development system that contains research, didactic, leadership and digital components is of particular relevance. Teacher trainings play an important role in educational systems of many developed countries. In Finland teacher trainings are organized at the working place by the educational institution, by The National Board of Education, by The National Centre for Professional Development in Education, by teacher training departments and at higher education institutions with credit system of study (OECD, 2011).

In Great Britain teacher trainings are arranged using one of two models: course model on the basis of higher education institutions and school based in-service education (Machin and Vignoles, 2005). The process of teacher training in Canada is provided by different educational institutions including universities, departments of education, school boards, regional centres of education, volunteer organisations, teachers communities and privat professional development companies (Thomas, 2013). Professional development of American teachers takes place at higher

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educational institutions of different levels (Darling-Hammond et al., 2010).

This leads us to the question of a higher educational institution as a teacher training provider. The aim of the paper is to describe a differentiated system for digital professional development of university teachers implemented on the basis of Borys Grinchenko Kyiv University. In particular, the authors consider the question of teachers digital competence level determination and providing a differentiated approach to learning through the system of mini courses for personalization of teachers learning trajectory in digital sphere. The structure and the topics of the courses are offered to meet the needs of teachers at different levels. Also the possibility of formative assessment implementation at advanced levels is taken into consideration for high quality learning provision.

The analysis of current research has shown that a significant number of scholars pay a lot of attention to this issue. Seel and Zierer (Seel and Zierer, 2019) stress that the implementation of digital technologies in education will be effective if it is teacher and pedagogy rather than technology that takes the lead: "The main focus of educational responsibility has always been human development. The human being in pedagogy is both the starting point and the end result. This approach must also be applied to the digitalisation of education. Digital technologies cannot become a substitute for the pedagogical component of the educational process. Moreover, digitalization must be subordinated to pedagogy". Meyers et al. (Meyers et al., 2013) believe that the development of digital technologies and tools requires new knowledge and skills from the educator; the educator should ensure that applicants for education master digital tools in order to be ahead of the younger generation and help them master the necessary competencies to increase the availability of new knowledge.

Yarbro et al. (Yarbro et al., 2016) stresses that in the digital space it is the teacher who determines the pace of learning, organizes the topics that implement subject knowledge, and is responsible for students' learning progress.

The Digital Competence Profile of Educators (DigCompEdu, 2017) proposed in 2017 describes 22 competencies, the focus of which is not on technical skills, but on the teacher's ability to use digital technologies to provide high quality education.

Kluzer and Pujol Priego (Kluzer and Pujol Priego, 2018) describe the implementation practices of the European Digital Competence Framework (Dig-Comp) consisting of 50 case studies and tools.

Ottestad et al. (Ottestad et al., 2014) define the digital competences of an educator as a set of com-

ponents: general, which includes general knowledge and skills that teachers should have; didactic, which reflects the digital specificity in each discipline and professional oriented with a description of digital rice.

According to the 2021 EDUCAUSE Horizon Report (Pelletier et al., 2021) at the beginning of the pandemic, educational institutions started to develop portals/hubs that included different educational resources and use new teaching strategies. The educational reference materials presented on them to help teachers move quickly from traditional to online learning. One of the best examples was the training of teachers at Indiana University and its partners. The developers actively developed the site's resources, allowing them to quickly review and redistribute materials to meet faculty needs. The site, its structure and content have also been used in the future not only by colleges and universities in the United States but also by other higher education institutions.

The pandemic and martial law require new pedagogical approaches for educators to rethink the ways and methods of delivering educational content to applicants, motivating them, establishing electronic communication and collaboration, performance assessment, interactive tasks preparation and formative assessment.

At the same time, an important point in defining quality is standardization, which is a complex multifactorial process.

The Standards and Guidelines for Quality Assurance in the European Higher Education Area (ESG) (Tomas and Kelo, 2020), standards for quality assurance in higher education: internal and external, based on the experience of quality assurance in the Western European countries, set the only European format for quality assurance systems and the creation of a single European educational area. The documents stipulate that HEIs should have certain procedures and criteria to validate the qualifications and professional level of teachers. Given that Ukraine is a party to this space, higher education institutions implement these standards, which are specifically stated in the Law of Ukraine on Higher Education (On Higher Education, 2017).

The professional standard for the group of professions "Teachers of Higher Education Institutions" (Standard, 2021) defines the conditions for the professional development of teachers and specifies a list of their job functions, each of which provides a detailed description of professional competences, noting the necessary knowledge, skills and abilities, a considerable part of which require a sufficiently high level of digital competence.

Taking into account the above-mentioned require-

ments in the professional standard of a teacher at Borys Grinchenko Kyiv University the “Teacher Profile” was developed, which reflects the manifestation indicators and learning outcomes of a university teacher in the context of such qualities: didactic, research, leadership and digital competence.

## 2 DIGITAL PROFESSIONAL DEVELOPMENT OF UNIVERSITY TEACHERS

Professional development at the University is implemented in five modules: digital competence module, research competence module, leadership competence module, didactic competence module, professional competence module (Borys Grinchenko Kyiv University, 2015; Morze et al., 2022).

The digital competence module is offered to teachers to develop information and digital competence, namely an introduction to modern educational trends in the process of digital transformation, ways of introducing innovative pedagogical technologies based on various digital instruments into the educational process, 21st century skills, the peculiarities of blended and online learning arrangement. Participants explore digital tools for creating high quality e-content, implementing formative assessment, effective communication and collaboration. Learning takes place in a blended learning format using the e-learning course “Digital Module” located in the university’s e-learning system.

In order to improve the teacher professional development system, teacher satisfaction with the process and the learning results is constantly monitored. To analyze the dynamics of professional development indicators analytical data is tracked in real time using a modern business intelligence tool – Microsoft Power BI, which is a set of business intelligence services with cloud support for data analysis and visualization. The main advantage of this tool is the ability to build interactive dashboards, with key performance indicators that are available for viewing from any device connected to the Internet (Microsoft, 2022).

The availability of reports enables the top management of the University to analyse the development of the teaching staff in dynamics, and for the teacher to rationally build a trajectory of further self-development.

## 3 THEORETICAL BACKGROUND AND PRACTICAL IMPLEMENTATION

According to the Concept of Digital Competence Development to improve the system of professional competence the Corporate Standard of Digital Competence of University Teacher was developed, introduced to increase the level of digital competence of teachers, which is recognized as one of the key competencies of successful person of the 21st century, to improve the quality of educational process, actualization of competitiveness of teachers by mastering new digital competences. The spheres of application of digital competence at Borys Grinchenko Kyiv University are determined by the main types of teacher’s activities: teaching, research activities, professional communication and cooperation; digital self-management. Five levels of digital competence are defined:

- Analyst-Researcher (A), which is mandatory;
- Integrator (B1) Expert (B2) – sufficient
- Leader (C1) Innovator (C2) – high.

As teaching and research activities are the prevailing ones for HEI teachers, the courses covering corresponding topics receive more attention especially at lower digital competence levels (figure 1).

The volume of a level varies from 50 to 60 academic hours. The average duration of a mini-course is between 2 and 6 academic hours. Some topics are introduced at different levels so that any gap in the knowledge on the topic could be covered. For example, at the Analyst-Researcher level there is a course “Basics of e-communication and e-collaboration”. At the Integrator level the topic is presented by two courses: “Collaboration arrangement using digital instruments” and “Digital instruments for communication”. That means that a teacher with a higher level of digital competence could return to the basics on the specific topic when needed.

### 3.1 Model of a Differentiated System for Digital Professional Development of University Teachers

According to the approved digital competence standard, the systems for enhancing teachers’ digital competence have been amended and the practice of compulsory university-wide testing of teachers has been abolished. Instead, a differentiated system of professional development has been developed, which is

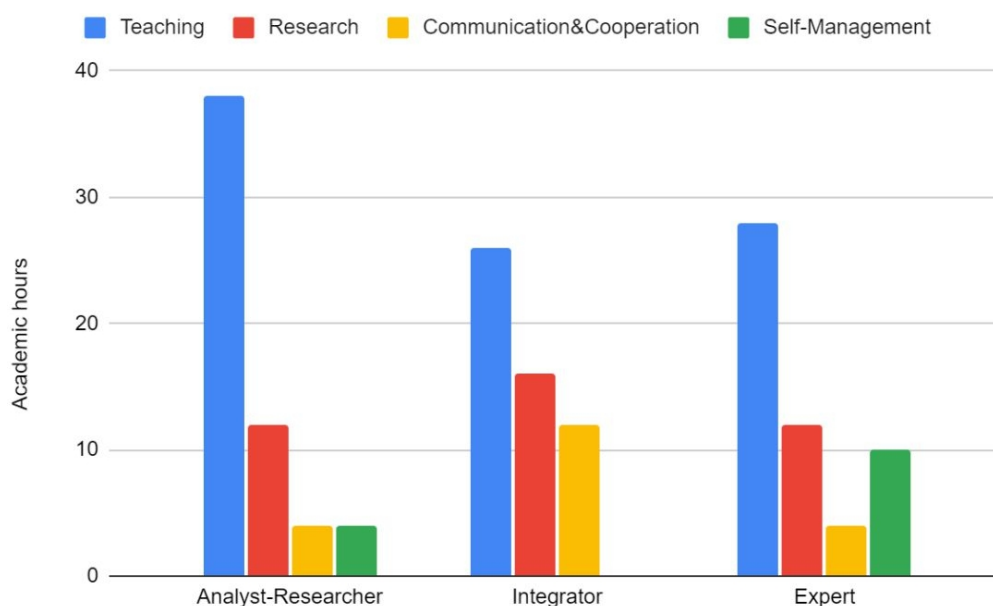


Figure 1: e-Courses by the types of activities.

based on self-assessment, self-study, the principles of microlearning, e-learning, etc.

The differentiated professional development system contains a diagnostic test and a structured set of mini-courses that are presented according to the levels of digital competence.

The differentiation of the system is provided with the help of micro modules placed in the e-learning system of the university. Online storage means that teachers are not limited in the choice of time and location to work with the courses. Such organization also makes it possible to build your own professional development trajectory by choosing the sequence of learning. Teachers are not forced to take all the topics presented in the level. They are also allowed to return to lower levels to refresh their knowledge. That is the content can be adapted to the professional needs of a teacher at the moment.

The model of the differentiated professional development system is shown in figure 2.

The developed model allows the teacher to be aware and self-motivated to improve their skills, including in the digital skills, using a diagnostic test and passing mini-courses.

First of all, the level of digital competence of a teacher is determined by the results of a diagnostic test, mastery of level mini-courses with the possibility of building an individual trajectory of professional development and the marking in a personal office of the achievement of the appropriate level – the digital footprint.

### 3.2 Diagnostic Test to Determine the Level of Digital Competence of a Teacher

The development of a diagnostic test to determine the level of digital competence of a teacher was carried out in several stages. Firstly, the goals of the test were defined – self-assessment of the level of digital competence and determining the need for its further improvement. It is self-assessment that lies at the heart of a teacher’s motivation to choose their own trajectory of professional development and improvement of digital resource skills. Traditionally, goal classification has been implemented similar to Bloom’s taxonomy (Bulakh and Mruha, 2006), but according to the levels of digital competence defined in the Corporate Standard, and the domain is described, will be diagnosed. It is defined that this test will assess the cognitive domain, i.e. knowledge and attitudes towards aspects of digitalization in the areas: learning activities, research activities, professional communication and cooperation; digital self-management. Indirectly the psychomotor domain is assessed, because the passing of the test takes place using a digital tool in a differentiated system developed. The objectives do not include and consequently do not offer tasks for the assessment of the personal emotional domain.

The choice of testing as a measurement method offers a number of advantages given the rapid response in the self-assessment process. The diagnostic test determines the level of digital competence of teachers, i.e. the competences that colleagues have

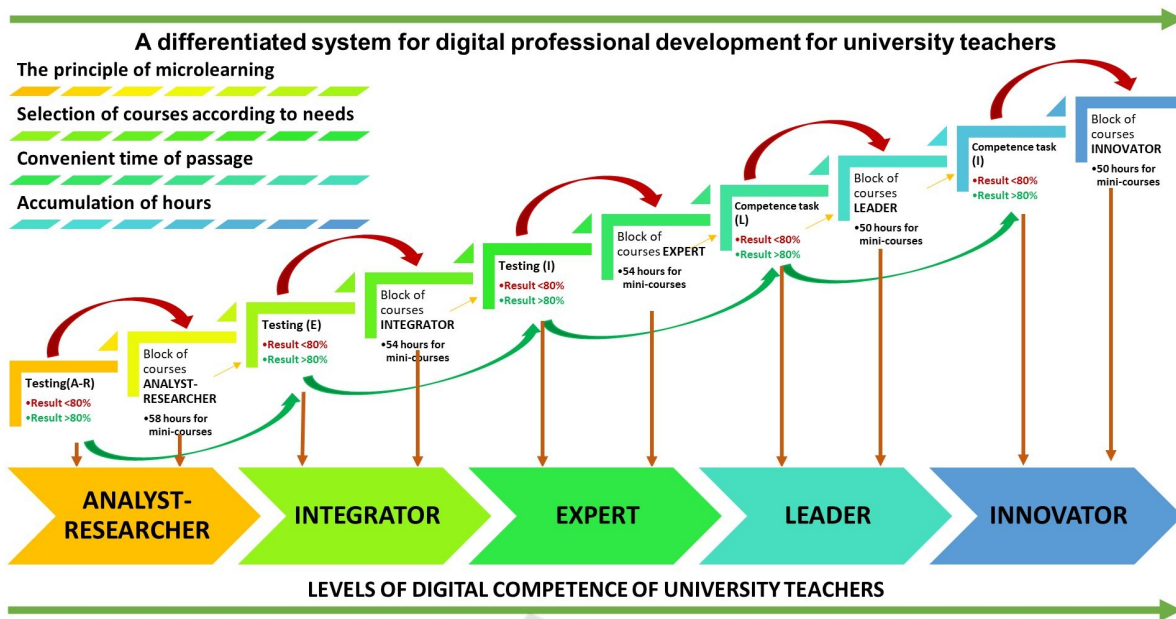


Figure 2: Model of a differentiated system for digital professional development of university teachers.

or do not have now according to the given descriptors of the corporate standard, detailing the skills of university teachers according to the levels of digital competence and the areas of application.

Secondly, a base of test tasks is created according to the matrix, which is developed based on the structure of digital competence standard and 97 descriptors. The matrix is three-dimensional 1 dimension is one of the four activities of a university teacher; 2 dimension is one of the five levels of digital competence; 3 dimension is conditional horizontal lines of development of a certain competence, which are formed according to the content and aspects of the activity.

In order to be able to provide a variable diagnostic test to determine the level of digital competence 3-5 alternative test tasks to each descriptor are provided.

The choice of test item formats is limited by the capabilities of the chosen tool, i.e. LMS Moodle. We use test tasks of the following types: multiple choice with one or more correct answers, yes/no questions, establishing logical sequences or correspondences. Graphic objects of a certain quantity are used in the test tasks, but more textual materials.

Thirdly, in the process of shaping the test its integrated nature is taken into account and in connection with those two lines are defined, i.e. the test has subtests in accordance with the activities of university teachers and on the other hand it is integrated according to the levels of the CC. A decision was made at the physical conclusion of the test and accordingly it was taken into account in its specification, the sub-

tests of the activities to be concluded into a test for the specific level of the GC. Thus, a separate test for the confirmation or non-confirmation of the Analyst-Researcher level is created. The results will be processed as soon as a statistically relevant number of participants is achieved for the analysis and the summarising. There is no need to equalise the test when concluding it for a particular GC level, because its balance in terms of difficulty has already been taken into account, and consideration of the logical coverage of meaningful questions is provided by including test items in accordance with the matrix for the establishment of comprehension of the competence described by each descriptor without exception.

The validation process to establish the validity and reliability of the test results will take place in parallel. The participants will be informed of these nuances. The passing score is provisionally set at 80%. However, the feasibility of such a limit to determine the pass/fail result will also be tested and adjusted if necessary.

For professional development using the differentiated system the teacher is firstly invited to take the test to prove the compulsory level of digital competence “Analyst-Researcher”. If the teacher enters 80% of points, he/she can receive a certificate of confirmation of this level, or take the test of the highest level. If the compulsory level is not confirmed, the teacher can take the mini-courses directly in the differentiated professional development system. The list of mini-courses on offer generally enables the teacher to practise all areas of digital activity in accordance with the

requirements defined in the standard.

### 3.3 Multi-Level Mini-Courses in an Differentiated System for Digital Professional Development of University Teachers

The title of each course indicates the number of hours that are allocated to studying the material and what will be entered into the accumulation system, there are also marks on the percentage of completion of the course and its completion.

The courses in the system are built on the basis of microlearning which allows personalization achievement of teachers learning path by several indicators including time framework, level of knowledge, conformity to teachers needs in digital technologies implementation.

Mini-courses contain educational materials, including mandatory ones with the appropriate mark, and a final test (for the levels Analyst-Researcher – Expert) (figure 3).

At the levels Leader and Innovator formative assessment is used to track the courses participants progress. As at the above mentioned levels users have become not only educational content consumers, but also its authors and distributors, they are capable of assessing their own progress according to the set criteria as well as assess the results of the co-learners activities. According to CCSSO formative assessment (Formative Assessment for Students and Teachers (FAST) State Collaborative on Assessment and Student Standards (SCASS), 2022) is a planned, ongoing process used by learners and teachers in the educational process to reveal and use results of student learning to improve student understanding of intended learning outcomes and support students in their individual learning path. Effective formative assessment process (figure 4) includes the following steps: identifying learning goals and the ways to achieve them, analyzing student's achievements within their learning path, providing self-assessment and peer feedback, using received feedback to improve further learning strategy.

At different steps of learning formative assessment can be performed using various digital instruments including those available in Moodle. Steps 1 and 2 can be implemented by Checklists in Moodle or with the help of whiteboards. In the activity Checklist students there might be a list added by the course designers, but students can be allowed to add their own items. To encourage students to work with checklists, grades and activity completion options might be set

up, so that a course won't be completed unless this activity is done. Implementation of such activity makes learners analyze their expectation from the course and estimate afterwards what is achieved and plan further steps for improvement.

Step 3 has the widest variety of activities and instruments for implementation.

Quizzes still remain one of the options. However, at Leader and Innovator levels those activities, which allow not only to check the knowledge but also to analyze, widen and implement it, should be given preference. For example, it can be such activities in Moodle as Forum and Wiki or external instruments such as whiteboards, mind maps can be used.

There are different forum types available in Moodle (figure 5) which can serve different purposes: standard forum for general use, a single simple discussion, each person posts one discussion, Q and A forum, standard forum displayed in a blog-like format.

Standard forums are the most suitable for connectivism learning application, when students learn from each other. This type of forum allows learners to create an unlimited amount of topics as well as leave comments on existing topics. A student can read answers of co-learners before giving their own answer, which contributes to their understanding of a theme. Standard forums are also the best option for a help forum as previous questions and answers can be studied before adding your own one, so the answer might be found even without questioning. Each person posts one discussion forum is similar to a standard forum, but it lets one user create only one topic. Q and A forum requires a student's answer before viewing other learners' posts. This type of forum makes a student find their own solution to a given task and then gives an opportunity to compare it with other options.

A single simple discussion is a forum where students cannot create their own topics, but only give answers to the existing one. This type of forum might be used for assessment criteria discussion or feedback on some topic.

Feedback is important both for a learner to improve their learning strategy and for course authors to apply changes to the course. Moodle provides several options for feedback implementation. First of all, a checklist created at the beginning of the course is helpful for a learner to estimate whether they achieve their goals or their learning path requires some changes. Secondly, Questionnaire and Feedback activities can be used. Feedback answers might be shown to all participants or available to the course creators only depending on the goals; it can also be anonymous. Feedback templates can be created to be

Analyst-Researcher	Integrator	Expert
Basics of e-communication and e-collaboration (2 hours)	Collaboration arrangement using digital instruments (4 hours)	Theory and practice of digital tools utilisation in different kinds of activities (6 hours)
Basics of netiquette and corporate culture (2 hours)	Digital instruments for communication (4 hours)	Interactive learning resources design (4 hours)
Work with scientific profiles (2 hours)	Methodology of statistical data processing (4 hours)	Digital tools for professional self-presentation (6 hours)
Checking a scientific publication for uniqueness (2 hours)	Use of advanced search in scientific databases (4 hours)	Means for students' project (group) work arrangement (4 hours)
Collection and analysis of statistical data (4 hours)	Video filming and editing (4 hours)	Design and utilisation of interactive videos (4 hours)
Quotation rules in scientific publications and bibliographies (4 hours)	Use of bibliographic managers and cross-references (4 hours)	Different types of web-conferences arrangement depending on needs (4 hours)
Gradebook maintenance (2 hours)	Infographics utilisation for learning materials design (4 hours)	Implementation of scientific statistical data analysis using digital instruments (4 hours)
Assessment of students' study achievements in the e-learning system (2 hours)	Implementation of peer assessment in ELC (4 hours)	Adaptive educational activities arrangement (6 hours)
Use of digital instruments with corporate account (4 hours)	Use of ELC for microlearning implementation (4 hours)	Layout of publications in Latex (4 hours)
Work with ELC (10 hours)	Use of ELC for blended learning implementation (4 hours)	Professional YouTube channel creation and editing (4 hours)
Video design and utilisation (4 hours)	Interactive quizzes (4 hours)	Work with international scientific communities (4 hours)
Infographics design and utilisation (4 hours)	Integration of MOOCs into educational process (2 hours)	Systematic utilisation of innovative pedagogical methods in ELC (4 hours)
Structuring and visualising theoretical materials (4 hours)	Arrangement of work with colleagues using corporate accounts (4 hours)	
Use of digital instruments for planning work (4 hours)	Arrangement of students interaction during a web-conference (4 hours)	
Online classes arrangement using web-conference tools (4 hours)	Layout of publications (4 hours)	
Main types of quizzes design (4 hours)		

used in all courses of the system.

Thus, courses of Leader and Innovator level (figure 6) follow all steps of the formative assessment process from setting up goals to feedback and further learning strategy planning.

The system provides tracking of tasks and own learning progress (figure 7, 8).

The full completion of the mini-course is displayed in the block "Status of completion of the course" of the mini-course, and the points scored, i.e. hours, are automatically displayed in the Gradebook of a certain level of digital competence (figure 9).

The analysis of data from the additionally in-

stalled plug-in block "Progress of completion" and the report "Activity completion" for each level of digital competence separately allows to evaluate the progress of each teacher in mastering mini-courses of a certain GC level, to identify which mini-courses are most or least in demand for further consideration in the process of improving the system as a whole (figure 10).

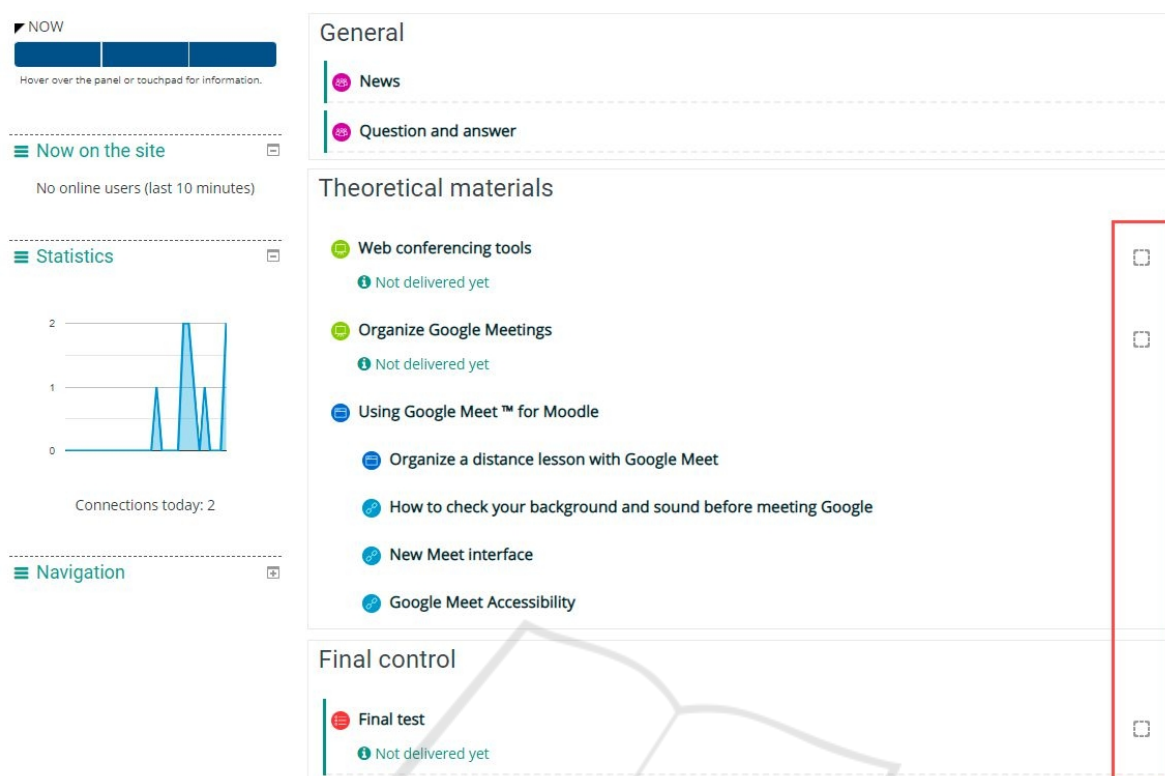


Figure 3: Example of the mini-course for Analyst-Researcher level.

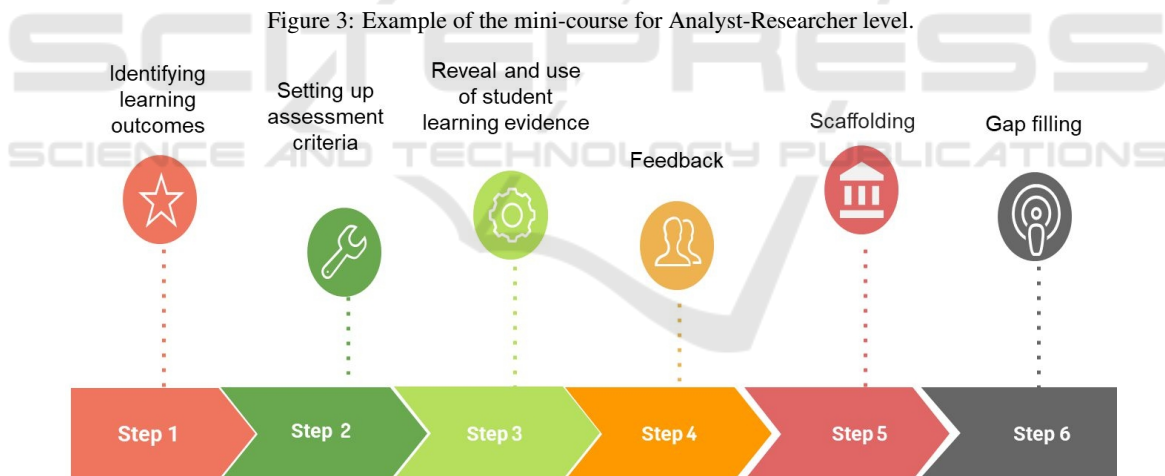


Figure 4: Formative assessment process.

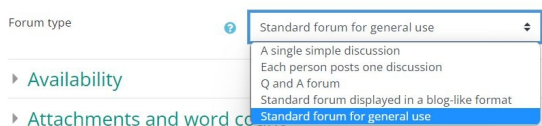


Figure 5: Forum types in Moodle.

#### 4 CONCLUSIONS AND FURTHER RESEARCH PERSPECTIVES

Today’s requirements and normative documents adopted at different levels prompted the research par-

ticipants to review approaches and methods of professional development. Thus, a differentiated system for digital professional development of university teachers was designed in accordance with the model presented in the paper, where the main parts are digital competence levels, diagnostic test, sets of mini courses for each level of digital competence.

The designed diagnostic test considers the need for integration of digital instruments implementation skills in all kinds of teachers activities: research, teaching, professional communication and



ONLINE CONFERENCE MANAGEMENT

- Announcements
- Q&A Forum
- Learning Outcomes Definition

Theoretical material

- Web conferences characteristics and needs
  - 0 attempted
- Online conference instruments for different purposes
  - 0 attempted
  - Web Conferencing and Online Meeting Tools
  - Using Microsoft Teams
  - Using Webex Meetings
  - Using Zoom

Practical tasks

- Discussion forum
- Self-check test
  - 0 attempted

Feedback

- Feedback
  - 0 submitted

Figure 6: An example of Leader level course.

- Organize Google Meetings
  - There was an attempt on September 7, 2021

Figure 7: Tracking the performance of mini-course activities.

digital self-management. It is aimed at the current level of teacher digital competence definition.

Level mini-courses, arranged according to the levels of digital competence of the teacher, declared in the developed Corporate Standard of Digital Competence, contain materials according to the defined descriptors by types of activities. Teacher qualification improvement in the differentiated system begins with passing a diagnostic test, based on the results of which redirection is made to take mini-courses of the appropriate level.



Figure 8: Progress of implementation.

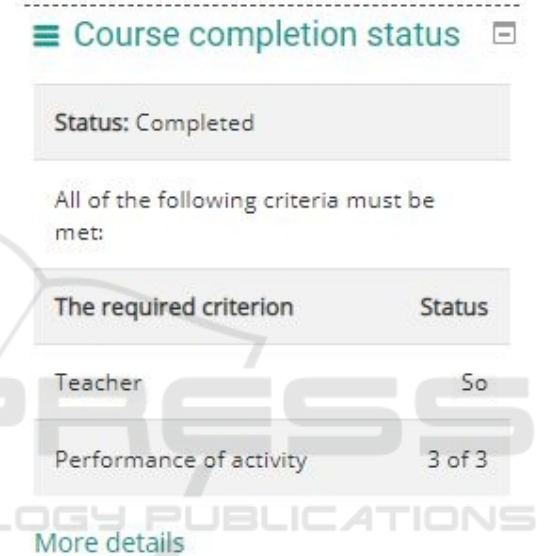


Figure 9: Course completion status.

The designed differentiated system for digital professional development allows to personalize teacher's learning path by providing possibility to choose courses within the determined level or below according to the teacher's needs, gaps in the knowledge and topics of interest. Related topics are placed at different levels which provides learners with an opportunity to widen and deepen their knowledge on the most required themes as well as to return to the previous level. As the courses are built for self-learning, the participants are not limited to a certain time or location. Altogether these promote the self-motivation of teachers to increase the level of digital competence and, accordingly, the quality of providing educational services in general.

Implementation of formative assessment at the advanced levels of the system provides learners with wider study options as they not only consume information presented in the course, but also identify their own goals, track their progress, learn from each other and perform self assessment and peer assess-



Figure 10: Activity Completion Report.

ment. Such activities available in Moodle as Forum, Checklist, Feedback, Questionnaire and others can be used to arrange formative assessment.

In the future, it is planned to expand the system of teacher training in other areas: research, didactic, leadership, professional. This will allow teachers to acquire additional knowledge and constantly improve their skills to perform their professional duties.

The experience of the differentiated system for digital professional development implementation might be useful for other universities which can take the offered system as a basis and adapt it to their conditions and needs.

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