



Digital Competencies Development in Higher Education Institutions: A Mixed Methods Research Study

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Abstract

Objective: Learning to teach at the higher education level is not a straightforward path in Slovakia, and there are fewer opportunities to learn how to teach at this level. The paper summarizes selected findings and proposals for improvements related to the implementation of measures in selected areas of higher education institutions (HEI). The aim of the paper was to explore digital competency development in higher education institutions and factors with regard to university lecturers that affect the quality of the educational process in the context of the overall quality of graduates and labor market requirements. In addition, our study aims to fill an information gap and provide original data useful in the process of digital competency development in higher education. **Methods/Analysis:** The study employed an exploratory mixed-methods design. The data for this study is based on a survey with 24 open and closed questions and an analysis of 46 final thesis studies. **Findings:** Both the qualitative statements of the university lecturers and the survey shed light on the following: (1) (Re)creation of motivational factors; (2) Potential development of digital competencies; and (3) Supporting innovation in higher education. The results led to consideration of the educational process quality at the level of the subject and the object of education. **Novelty/Improvement:** The results point to the importance of investment in technology. This is related to improved educational outcomes and sustainable innovation in higher education. Slovak national education policymakers should provide innovative ways to increase the development of digital competencies in higher education institutions through the Recovery Plan for Europe; providing investment in technology related to improved educational outcomes and the development of sustainable innovation in higher education will all help to raise the standard.

Keywords:

University Lecturer;
Course in Academic Teaching;
Final Thesis;
Motivation;
Digital Skills and Competencies.

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1- Introduction

The university (or higher education) lecturer's profession is very heterogeneous and diverse, varied, and abundant. Lecturers have to learn throughout their whole career, cultivate their own personality, and develop their own potential. The crucial development of one's own capability is always connected with self-motivation and trust in progress [1, 2]. Every day, the higher education lecturer is confronted with innovations and permanent social changes, which they should comprehend and then incorporate into their expert activity [3]. Learning to teach at the higher education level is not a straightforward path, and there are often few opportunities to learn how to teach at this level prior to taking on a teaching position. Several studies have shown that digital competences are not always fully incorporated in the daily work of higher education lecturers, and this is defined in research as a significant omission [4-7]. It is a challenge for HEI to focus on motivation and the development of sustainability in innovations, in addition to the importance of investment in

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digital transformation. Universities should monitor, via freely available and internationally approved tools, the extent to which lecturers accomplish their teaching duties and endeavor to improve their teaching skills and aptitudes, as well as their attitudes towards and commitment to students [8]. The DigCompEdu Check-In self-assessment questionnaire is one of the free available options in electronic form that serves as a tool for the digital mapping of competencies for all higher education lecturers [9-11]. However, the question arises as to whether the lecturer in higher education is sufficiently prepared for pedagogical activities in the current challenging conditions of practice. In the context of the processes of globalization and internationalization of all areas of social life, there is a requirement for defining learning quality standards as part of internal higher education quality standards, both in the fields of research and educational activities and goals of the institution [12-15]. The basic goal of educational activity should be a competitive graduate whose knowledge and skills are at the level of the most up-to-date scientific knowledge, and who is available to the labor market [12, 16]. The motivation for further education and the motivation of the individuals working in universities have been topics of great interest for researchers for a long time [17, 18].

Digitalization plays a vital role in the education sector, starting from primary schools through colleges and universities [19]. Digital devices and the Internet have become particularly important and powerful components of young people's lives. Education requires a good understanding of the digital practices and behaviors of students [20-23]. Digital transformation improves some skills in the new digital society, has an important role in reducing costs related to education, and is also able to increase students' abilities in personal communication [24]. Several studies have concluded that when students utilize learning technologies, such as virtual reality headsets, 3D simulations, podcasts, design software, and so on, they leave numerous information trails enabling interested parties to determine their opinions, social connections, expectations, and objectives. They concurrently employ ICT in bringing theoretical and practical preparation for the teaching profession [21]. Today's students live in a world in which being plugged into technology is a way of life. Almost every part of their lives has some root in the technological revolution. A blended approach combining professional development workshops, curricular examples, and a peer-support system [25] is the most successful way of increasing professional development for technological integration. Accordingly, it can be summarized that digital skills and competencies in higher education have even broader possibilities than just their implementation into the teaching process [12, 13, 26]. All graduates entering the labor market are required to use ICT in their future jobs, just as lecturers themselves are required to use ICT as a teaching tool in addition to administration purposes [16]. It is undisputed that the current young generation is digitally very proficient (the level of competence is very high); however, the level of information competency (literary competencies, document competencies, or numeric competencies) and application seems to be problematic [27]. Secondary school graduates who enter higher education expect appropriate use of modern technologies at the universities.

Our study will be focused on university lecturers at the Slovak University of Agriculture (SUA) in Nitra in the Slovak Republic. One portion of the respondents of our study were university lecturers who had participated in the Course in Academic Teaching qualification. The Course in Academic Teaching qualification has been held every two years continuously for 57 years (since 1964 - the establishment of the Department of Education at the Slovak University of Agriculture in Nitra). The Course in Academic Teaching qualification is accredited for the period 2021-2025 by the International Society for Engineering Pedagogy (IGIP) in Villach. Educational activities were organized by the Center of Education and Psychological Counseling (further CEPC) at the Faculty of Economics and Management (formerly the Department of Pedagogy and Psychology) as an independent course of engineering pedagogy, in two-year cycles lasting 3 semesters. It takes place as an internal form of further education for university staff and leads to the learner obtaining a certificate of completion of the course. As stated in the course project 'University Pedagogy Academic Teaching' [25], the aim of the course is "to provide lecturers with the necessary relevant and current information and knowledge in the field of engineering pedagogy and higher education pedagogy, psychology, social sciences - sociology, sociology of education and ethics, higher education didactics - and the application of modern educational technologies and tools of dissemination of educational (professional) content." There are also several optional offers at this university, including a philosophy course. Its purpose is to help general orientation [28]. The content focus and all the activities of the course should be helpful in acquiring skills in the field of pedagogical communication in the educational process at the university, and to increase the overall quality of higher education.

Several studies show that some of the higher education institutions pay less attention to the issue of digital competencies and literacy development in their curricula than would be desirable [29-32]. Lecturers' digital competency is necessary for their teaching activities and directly affects the level and development of the students' digital competency. According to Tømte et al. [32], the development of digital competence is not supported in most teacher training curricula. The results of present research [33-35] point out the prevailing focus on teachers' self-assessment and reflects on their digital competencies. Lecturers generally assess their own digital competencies in both pedagogical and technological knowledge as low or medium; additionally, most university students have a basic level of digital competence [34].

Despite the relatively rich area of studies addressing the issue of digital competencies, it is important to further develop and improve research in the higher education area and improve lecturers' and students' digital competencies according to more personalized training programs that respond to the educational needs of lecturers. It is important to

explore the factors and motivation influencing digital competencies. Thus, to fill the research gap, we propose to explore digital competencies development in higher education institutions and the potential factors, relating to university lecturers, affecting the quality of the higher education process in the context of the overall quality of graduates and labor market requirements based on our research at the Slovak University of Agriculture in Nitra, Slovakia. Specifically, this study focused on the question: “Which potential factors, with regard to university lecturers, affect the quality of the higher education process in the context of the overall quality of graduates and labor market requirements?” The follow-up questions to the major research question are:

RQ1: What are the needs of university lecturers in relation to digital competencies and innovation in higher education?

RQ2: What do we know about university lecturers’ self-motivation to further their education?

2- Material and Methods

The most appropriate research design for this study was the exploratory sequential mixed-methods design, [36]. In accordance with this design, this study is composed of two phases; the first phase, qualitative data collection and analysis, was conducted to identify the digital competencies of lecturers in higher education and the potential factors influencing the quality of the educational process. The second phase, quantitative data collection and analysis, aimed to refine and assess the validity and reliability of the research data through document analysis of the final thesis of course participants.

Document analysis is a technique that uses a variety of documents, both printed and electronic [37]. It is important to note that document analysis is a process that involves skimming (superficial examination), reading (thorough examination), and interpretation of content to provide answers to research questions [38]. It is one of the widely used procedures for analyzing and reducing diverse textual material [39] and thereafter organizing it into categories. In our analysis, we endeavored to search for similarities and recurring themes of categories. The data for this study is based on a survey with open and closed questions [40] and document analysis [37].

2-1-Data Collection

A survey with open and closed questions was conducted. The study was based on a written survey containing a total of 22 questions, both closed and open. The questionnaire was emailed to 46 graduates of the Course in Academic Teaching at the Slovak University of Agriculture in Nitra (SUA in Nitra), Slovakia. The survey ran from August 2021 to September 2021. 39 graduates from the course (university lecturers) (84%) completed the questionnaires, and their data were included in the study. Answering the questionnaire took approximately 20 minutes. Data was provided anonymously. No identification of the university lecturers can be made. Respondents received an ID number between 1 and 39, depending on the time of arrival of the questionnaire.

There were 46 final thesis studies used from the Course in Academic Teaching. The authors of the final works are young lecturers at university and the topics grew from specific ties to the educational process. Since the course is intended for fledgling lecturers, as well as for young lecturers with some limited experience, the final thesis studies led to certain cross-sectional monitoring of views, evaluations, and attitudes of university lecturers. Closer attention was devoted to the implementation and combination of ICT in the pedagogical process itself. The inclusion criterion was that the final theses should be approved before the analysis. There were 35 (76%) final thesis studies submitted by women and 11 (24%) by men. All included assignments were anonymized before reading and analysis.

2-2-Data Analysis

The primary sources of the content analysis were 46 final thesis studies from the Course in Academic Teaching (the final theses are available in the Slovak Agricultural Library of SUA in Nitra), delivered in the years 2018 - 2019. The theses were created under the auspices of the Center of Education and Psychological Counseling of the Faculty of Economics and Management SUA in Nitra. A questionnaire survey for obtaining the feedback from the respondents (the authors of the final theses) was used as a secondary research method one-and-a-half years from the end of the course. After the collection of the surveys, the data were analyzed by statistical calculation and phenomenological analysis [41] by two of the authors (TŠZ and LJ). For this study, selected items from the questionnaire form were processed (Appendix I).

The final theses can provide important (and authentic) information about the real state of the learning environment in real-time, fulfill the function of indicators, and be helpful in identifying critical elements which ultimately affect both the quality of education and the students' opinions and attitudes. The study deals with the content analysis of a group of final theses in more detail, additionally focusing on the analysis and evaluation of digital skills and the development of digital competencies in higher education [39]. Considering the methodological advantages and limitations of document analysis [37], data analysis was determined by both the research objectives (deductive) and multiple readings and interpretations of the data from the documents (inductive). Given the multitude and variety of documents, thorough reviews were the first step in the analysis. Some documents, although originally selected given their content, title, or possible link, were not deemed appropriate to the inquiry. Figure 1 presents a flow chart of our research process.

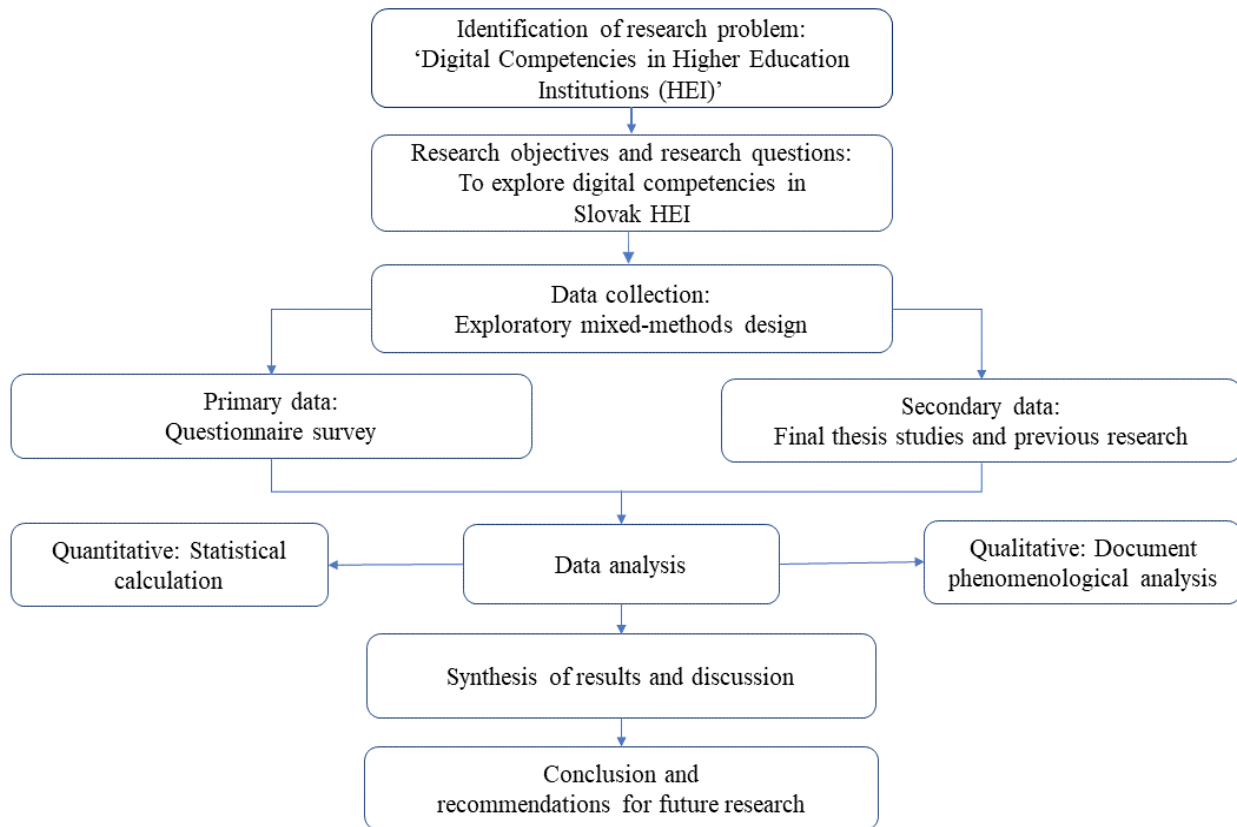


Figure 1. Flow chart of the research process

3- Results

The purpose of the study is explored potential factors which affect the quality of the educational process, in particular those appertaining to university lecturers, in the context of the overall quality of graduates and labor market requirements. Analysis of both the qualitative statements of the university lecturers and the survey shed light on the: (1) (Re)creation of motivational factors (2) Potential development of digital competencies (3) Supporting of innovation in higher education.

3-1-(Re)creation of Motivational Factors

Data from the survey showed (re)creating the motivation to complete the Course in Academic Teaching. Participants point to the dynamics of (re)creating motivational factors and recent changes in the motivation to study. In their final theses, the course participants primarily addressed the issues pertaining to the specific conditions of teaching their particular courses and subjects at higher education level, or they focused on specific problems associated with their own workplace (department) or faculty.

In the questionnaire survey, several motivational factors were identified which prompted lecturers to further their education. For illustration, we provide some selected results (see Table 1).

Table 1. Motivation to complete the Course in Academic Teaching

Answer	Number (N)	Percentage (%)
Requirement of the head of my department	2	8.3
Condition for professional growth	9	37%
Condition for the staff selection procedure	0	0%
My own interest	12	50%
partly self-interest and uncertainty whether this will be a condition for the staff selection procedure	1	4.2%
Total	24	100

According to the answers, it can be summarized that half of the respondents attended the course prompted by their own self-motivation; the rest of the participants were influenced by external institutional factors.

The results can be also supported by the lecturers' evaluations of course benefits. According to the respondents' opinions, courses in Academic Teaching are beneficial; no response indicated that they were of no use, as illustrated in Table 2.

Table 2. Evaluation of the benefits from the Course in Academic Teaching

Answer	Number (N)	Percentage (%)
Of no use	0	0
Partially beneficial	10	41,7
Very beneficial	14	58,3
Total	24	100

We used a survey with open questions to search for implicit descriptions of the motivation for further education. One participant (24) wrote: *"The Course of Academic Teaching should be completed by all those involved in the education of university students. I recommend it to current lecturers and doctoral students"*. Another participant (6) wrote a suggestion for improvement: *"Give students the opportunity to take the course remotely - it would be a great way to give a lecture."* Participant (37) noted: *"I would like to use more modern teaching methods with ICT links."*

The dynamics of (re)creating motivational factors have an impact on both the quality of the course for academic teaching and the opportunities for co-creating and participating in changing the course content. The social-contextual factors can lead to the desired educational outcomes and nurture intrinsic motivation and promote internalization.

3-2- Potential Development of Digital Competencies

The results confirm that social networks, as a means of informal education, offer a wide range of possibilities to support higher education. So far, students use this form of access for professional information only minimally. Social networks are now commonly used by universities for promotional purposes, but in the case of using professional websites and groups on social networks, students could penetrate significantly deeper into professional issues. The results show that students spend their free time on social networks, so it is possible to use the networks to obtain professional and up-to-date scientific information.

It can be stated that students use digital technologies more in their private life and free time, but they lack the ability to combine their skills with their study, respectively to apply their level of user ICT skills efficiently in their studies. Digital technologies are used in higher education to convey educational content, and most lecturers use ICT and require students to work with electronic information resources. However, the survey also indicated some challenges in this area, and it would be appropriate to analyze the syllabi of courses in higher education - especially the section 'recommended literature' - to identify whether electronic information sources are also represented. It is advisable to take account of the suggestions of students, particularly those who are advanced in the field of digital skills, so that lecturers could be inspired to develop and adapt the way the subject is taught. The results indicate some deficiencies and some potential challenges on the part of both students and lecturers. Students are aware of the possibilities of combining digital technologies and the attractiveness of educational content, and they perceive the pressure of social demands on the labor market, although their attitudes toward the use of digital media in their private activities and in their studies are often different. Ultimately, several points for improvement are raised. There is a need for lecturers to be able to handle digital technologies to an appropriate extent; students have pointed out the need for better functionality of school software versions; there is a need to use Open-Source solutions; and, importantly, the necessity of lecturer training. In the words of questionnaire participant 13: *"The idea of some lecturers using technology is tragicomic!"*

The lack of ICT skills and competencies of some lecturers, and their own awareness of this fact, can be proved by the survey results. The lecturers who responded to the questionnaire survey were asked to identify in which areas they felt there were weaknesses in their work. The range of answers included those who reported weaknesses in working with ICT. The answers by their frequency were as follows (Figure 2): pedagogical communication with students (4); work with ICT in teaching (4); development of study materials for students (3); applying a variety of teaching methods (12); creating didactic tests (6); evaluation of student results (3); nothing (6); new ways of motivating students (1); time management (1). Respondents had the possibility of giving multiple answers.

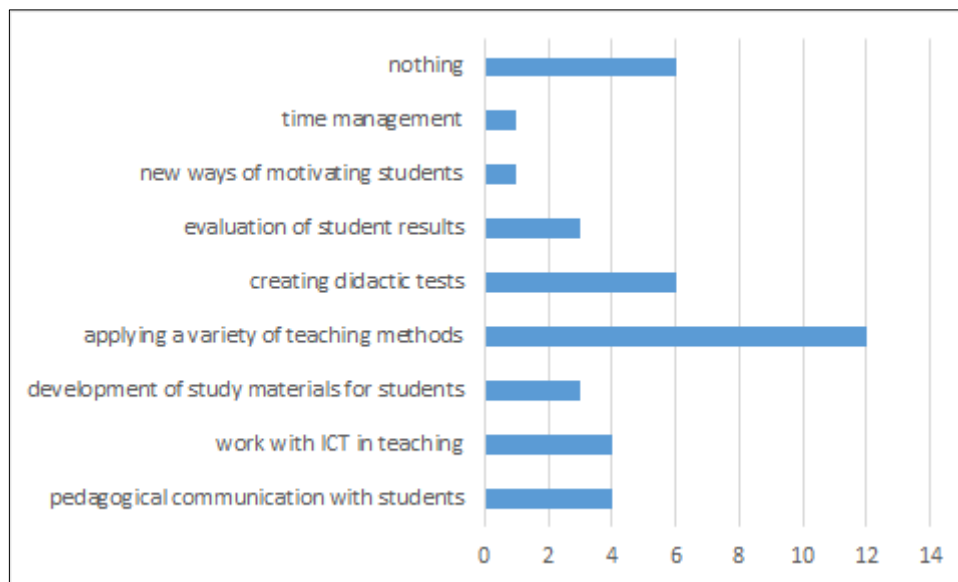


Figure 2. Areas of weaknesses in their own teaching as perceived by lecturers (multiple answers were possible)

The findings connected to deficiencies in the usage of ICT by university lecturers are supported by the results of our questionnaire survey aimed at the identifying the motivations for furthering their education. Only one respondent showed motivation to develop their digital skills and ICT competencies in further education. Respondents were asked to state which area they would choose to further their education in the future. The lecturers' answers are tabulated in Table 3:

Table 3. Areas of interest for furthering education

Answer	Number (N)	Percentage (%)
pedagogy	2	8,3
psychology	3	12,5
ICT	1	4,2
Foreign languages	10	41,7
Professional field specialization	7	29,2
Pedagogy, psychology, my study field	1	4,2
Total	24	100

The explanation of the questionnaire answers can be only hypothetical and need some further exploration, but possible reasons could be as follows: low self-reflection of lecturers on the level of their ICT competencies; minimal use of ICT in their teaching; however, it is also possible that the sample of our respondents are relatively proficient in ICT.

The interest of the course participants in improving the quality of their own teaching activities can be illustrated by the examples of the themes they expounded on in their final thesis. The results and conclusions of some of the final works written by the students promoted the development of teaching skills, digital competencies, and the overall quality of education. To illustrate, we selected several named final thesis works: 'The Level of Digital Competencies of Students in the Context of the Quality of Education: Empirical Study at the Faculty of Agrobiolgy and Food Resources'; 'The Application and Development of Digital Competencies and Creative Skills of Students in the Landscape Design Studio Course'; 'The Development of Digital Competencies Through the Active Support of Non-Formal Education as a Means of Motivating Students for Education and Self-Education'; 'The Digital Educational Environment and Educational Content as Stimuli of Interest in the Studied Subject'; 'Innovation of the Teaching Process by Creating an Interactive Sample Book of Selected Horticultural Species'; 'Possibilities for Using Licensed Electronic Resources by Students at the Faculty of European Studies and Regional Development SUA in Nitra'; 'Psychological-Didactical Aspects of ICT Implementation in Higher Education.

For example, in the survey on psychological-didactic aspects of ICT implementation in teaching the author found that 96% of lecturers use PowerPoint presentations (PPT). Most lecturers have used these presentations as teaching aids for more than five years. Most lecturers stated that ICT made their work easier, and it modernized their teaching methods

and forms, and all the surveyed lecturers rated the use of PPT presentations positively. Most lecturers stated that they only present the basic knowledge in the slides; the whole teaching content is always presented verbally and in more detail.

Our findings also include some significant differences between the views of lecturers and students in regard to PPT presentations. All the lecturers rated the use of PPT presentations in their teaching positively; however, students had a neutral response to the use of PPT presentations in the educational process, and they did not rate them exclusively as positive or negative.

Other results indicated several deficiencies in lecturers' presentation skills from the students' perspectives. Participant (17) stated in their final thesis: *"30% of the students described their experience of lecturers reading the text (from a PPT) word for word, but no teacher admitted it."* Another participant (3) noted: *"... 82% of lecturers stated that they have eye contact with students during the presentation and try to use discussion. However, only 60% of students confirmed eye contact, and just 28% confirmed a discussion with the lecturer."*

3-3-Supporting of Innovation in Higher Education

The results of the work dealing with the use of licensed electronic resources by students at one of the faculties indicate that trends in the use of these resources, as well as the identification of problems with electronic information resources (EIR), are comparable in students at both master and bachelor level, as well as in the group of university lecturers. All the university lecturers who responded agreed that the usefulness of EIR is undeniable, although they reported problems associated with working with the resources. In general, respondents had positive views on such key factors as speed of communication, availability, and quality. The basic problems they reported included language skills and knowledge of the professional terminology of students. Lecturers, however, reported problems associated with the processing of information obtained by the students and the absence of their critical thinking. They also reported insufficient use of licensed electronic resources provided by the university library. Most students did not access the knowledge of the availability of resources in the academic library (Slovak Agricultural Library at SUA), nor did they use the portfolio of resources. Some said it was easier to use Google and similar tools.

One thesis, which presented the results of the creation of an interactive sample collection of selected horticultural species, suggested a new tool in teaching which would be an innovative support base for the study of courses taught at the Department of Vegetables, Faculty of Horticulture and Landscape Engineering. The author proposed the sample book be interactively connected to the Internet using QR codes, with a link to a web page where the species and varieties are described in English. Their taxonomy and contact with the person who deals in detail with the issue would also be included. The answers in the questionnaire also showed that more respondents were aware of the potential benefits and uses of QR codes to aid study. The author of the work (participant 15) states that, from the point of view of the lecturer, the student of today is different from the student of ten years ago, and it is necessary to adapt the content and method of teaching to accommodate them. At a time when, due to the demographic curve and other parameters, universities are fighting for students (as their number declines from year to year), astute lecturers are trying to understand this trend and find the best way to attract the widest number of students to higher education.

To illustrate the trend, we analyzed the final theses and the students' ideas and answers to the question: "How would you innovate the teaching process if you had the opportunity? Participant 20 wrote that his/her students answered this question thus: *"It would be appropriate to focus more on the practical part of seminars and exercises (it works for most subjects) ... Make the attendance system more attractive (use more tools to motivate them)..."*; *"...QR codes in scripts for aiding better learning for exams...."*; participant 6 noted in their final thesis: *"It is best to learn in practice; technology will not improve it and can even make it worse; "...to include more practical demonstrations (lectures should be connected to manual work)..."*; *"More than some technological/technical innovations, I would appreciate the exercises/seminars to be covered in more detail, with the opportunity to watch e.g. some videos, or interesting facts from around the world, even some Googled, but verified by a lecturer;"* Participant 2 added: *"...more pictures, less text, information from practice..."*; *"Practical exercises in each course."*; *"I would rather welcome some excursions or practical demonstrations..."* A participant (15) of the open question in the survey noted: *"The Course in Academic Teaching should offer new topics, such as creative teaching methods, ways to teach, how to manage and reduce stress for lecturers and for students, how to improve communication with students ... I would also like to try some online methods during this course or some personality tests for self-knowledge."* Another participant (1) added: *"I am interested in teaching more in the field of pedagogy and education."* Participant 21 commented on the opportunities for innovation in higher education: *"I also see an opportunity for the speakers themselves to improve ... they should lead by example in terms of lecture innovation and the presentation itself...."*

Our data shows that higher education should reflect the newest trends in sciences and technology, some examples of which include tools using electronic information resources, virtual teaching aids, and the implementation of QR codes

for learning purposes. The need for technological innovations in education was supported by the analyzed final theses in which the opinions of students contained some suggestions for improvement, such as the implementation of the newest motivational tools in higher education, video tutorials, and practical development of the students' skills and competencies.

4- Discussion

This study aims to explore digital competencies development in higher education institutions and potential factors affecting the quality of the educational process, with regard to university lecturers, in the context of the overall quality of graduates and labor market requirements. It was conducted at the Slovak University of Agriculture in Nitra, Slovakia.

The participants of the Course in Academic Teaching, as well as the conceived thematic areas of the final thesis studies, ultimately point to the need for a pedagogical or so-called professional-didactic component of the training of lecturers at technical universities in domestic and foreign conditions, and the need to develop the didactic skills of these lecturers. The presented final theses have a common denominator - a deeper insight into the academic skills improvement of university lecturers, as shown in other research studies [8, 21, 22, 40]. In the context of the discussion, we are particularly interested in the potential development of digital competencies and supporting the innovations of the higher education lecturers themselves. Various studies prove that successful digital competencies utilization in teaching depends mostly on the personality of the teacher and their skills [29-34, 35]. The lack of digital competencies of higher education lecturers could be responsible for students who underperform in the digital area since if lecturers are not fully competent themselves it is difficult for them to pass on these skills to their students. Several researchers [33-35] described this evident gap when it came to facilitating students' digital competence. This finding correlates with several studies which focus on the digital competencies of higher education lecturers, which underlines the importance of the offer of lifelong or continuous training for lecturers in order to develop or improve their digital competencies [42-44]. OECD's Innovation Strategy [20] emphasizes that educators should consider adopting broad technology-supported learning and implement pedagogic models to improve students' learning outcomes, including the development of higher-order thinking skills, and to expand the range of learning opportunities available to students. Innovative approaches to technology-supported learning can enhance education; examples include educational gaming, online laboratories, technology-enabled collaboration, real-time formative assessment, and technological support for skills-based curricula.

The document 'Analysis of Acquisition of Cross-Cutting Competencies at Slovak Universities', published by the Slovak Centre of Scientific and Technical Information, contains the results of a survey and an analysis of the state of cross-cutting competencies in higher education at universities in the Slovak Republic [27] and includes a recommendation that universities declare targeted development. The survey, conducted among employers, yielded the following information: the importance of IT skills was confirmed by the majority of employers (70.4%); the knowledge of foreign languages was perceived as an important criterion for the admission of a university graduate to employment by approximately 60% of employers; and less than a fifth did not see the importance of foreign languages (18.9%), or they chose the option of both important and unimportant [44]. In our opinion, however, the requirement to combine digital and linguistic competence is already 'announcing' the setting of new conditions, and those who have the relevant linguistic dispositions can work more easily within the digital environment. Localization in the field of software solutions is no longer necessary. In addition, digital competence is already indicated in professional language training, including the ability to search for data in an electronic information environment (data mining requires knowledge of both search mechanisms and the ability to filter using 'the most common language of science').

The document also states that, in the case of the quality of the subjects of education, it seems important in the future to find a way to improve basic competencies in the field of science and technology, as well as the digital competencies of lecturers. Indirectly, through the final theses from the Course in Academic Teaching, it was possible to identify potential weaknesses in the quality/level of the student, such as the lack of ability to work with electronic information sources, insufficient mastery of terminology from a specific area (both in Slovak and English), areas where the language barrier was particularly problematic (most quality scientific sources are in English), and problems with a clear formulation of search criteria when working with Electronic Information Resources. University students are also often labeled as the 'Internet generation (or 'Google generation') and ICT is an inseparable part of university students' everyday life [30]. Further problems were identified with the transfer of electronic/virtual solutions from the private sector to the field of study support, a lack of work with professional resources (instead preferring the use of mobile devices to search for professional information and to share educational materials), and differences according to particular university faculties (for faculties such as Engineering the situation is better due to the use of more electronic solutions in the teaching; however, better access does not necessarily affect the quality of the graduates in terms of their ability to use ICT).

The Ministry of Education, Science, Research and Sport of the Slovak Republic is also the central body of the state

administration for higher education, lifelong learning and science. In the Recovery Plan for Europe, Slovakia has allocated financial support for digital development and increasing competencies and quality for education for the next few years. The second component of 'Education for the 21st Century' is described under the heading 'Reform 2' as 'Preparation and Development of Teachers for New Content and Forms of Teaching'. This is related to the plan under the heading 'Investment 1', subtitled 'Digital Infrastructure in Schools'. Slovak universities have a real opportunity through the Recovery Plan for Europe to improve future educational outcomes and sustainable innovation in higher education. Slovak national policymakers in education and particularly HEI have a range of possibilities to utilize innovative ways to increase digital competencies development through the Recovery Plan for Europe.

Furthermore, open science—innovation and knowledge transfer—is not just a field with possibilities for publication in journals or other publications with open access; open science encompasses unhindered access to scientific articles, access to data from public research, and collaborative research enabled by ICT tools and incentives. By combining the tools of science and information technologies, scientific inquiry and discovery can be sped up for the benefit of society. In this context, the analyzed final works indicate insufficient use of available tools and resources (such as open-source software for statistics, text editors, document processing, etc.; for example, statistical works are done exclusively with licensed software products such as SAS, etc.). To take into consideration the level of graduates' applicability in the labor market, the graduates come into real practice with their knowledge based on licensed software products, while the private sector works with open platforms because they are available free of charge and generally equivalent in quality to the licensed products. Graduates often do not encounter such platforms at all during their studies. Another challenge is due to the current pandemic situation: Are lecturers' levels of digital skills sufficient to facilitate distance education, and do they enable students to fully benefit from their online study? Several studies reported that one problem is that the methodical reorganization of the educational process, incorporating the use of information technology, has not taken place quickly enough to accommodate the current situation [45-49]. Transforming to online learning in such a short period is difficult, and university lecturers and students, some of whom may not have had any experience with online teaching or learning, have needed to adapt to the changes quickly. Such a rapid transition of learning modes may influence learning effectiveness and wellbeing [49-51]. Universities around the world need to adjust their methods and evolve the way they motivate today's students by providing them with a state-of-the-art learning environment [13, 52] that will not only motivate students but also improve the quality and reputation of the university. However, it is crucial that lecturers are motivated to seek self-improvement and further their education and competence development [4-7, 9-11]. In today's world, traditional universities must adapt and become smart (modern and intelligent) universities because, as can be seen with the worldwide pandemic, smart universities continue to thrive while traditional universities have closed their doors [13].

The findings indicate the important role of sustainable development and innovations in higher education. University lecturers sometimes need to take several courses with the goal of being up to date with current developments and learning to teach. University support has a significant role: to identify the gap between current and desired knowledge and skills connected to digital competencies, implement new strategies and digital programs, and constantly provide relevant training.

4-1- Strengths and Limitations of This Study

The main strength of this study is the many participants and the high return rate (84%), which increases its validity. The topic is relevant, current, and points to a new direction in the usage and assessment of final theses. Their importance can be seen not only as an evaluation tool for the assessment of knowledge and competencies gained from the particular field of study but also as a source of relevant information for the management and decision-making bodies in HEI. In this sense, the final thesis can highlight challenges for HEI quality improvement in specific contexts.

There are limitations; the analysis of the final theses from one university in the Slovak Republic is not representative of all the universities in Slovakia. It is suggested that more final thesis studies from different universities in Slovakia be investigated in future research. Additionally, we excluded final thesis studies that were not complete or relevant to the issue of digital skills, competencies, or use of ICT tools in education. The data in this study is based on a survey realized only at the Slovak University of Agriculture in Nitra. This study obtains data from one specific area, and we cannot generalize this information.

5- Conclusion

This study is intended to explore digital competency development in higher education institutions and potential factors affecting the quality of the educational process, and the quality of higher education lecturers in the context of the overall quality of graduates and labor market requirements. The study also aims to identify areas connected to what motivates lecturers to further their education and to improve their digital skills and competencies in higher education institutions, with research conducted at the Slovak University of Agriculture in Nitra, Slovakia. Our conclusions are meant to emphasize that university lecturers see courses in academic teaching as beneficial, and half of the respondents participated in them motivated by their own interest. Additionally, the development of digital competencies through specific assignments, along with practical and tangible tasks, supported and will continue to develop the creative inventions of students.

The findings of our study primarily contribute to the improvement of teaching and learning practices in higher education through the motivation of university lecturers to further their education and develop their digital competencies, as well as by supporting innovation in higher education. The analysis and evaluation of the training and courses provided for lecturers in HEI can be beneficial for future discussions and planning of the modules in their further education. Further, various tools for lecturers' self-assessment can help to improve the quality of higher education and particularly their digital competencies. In addition, the motivation of lecturers is crucial in the process of quality assurance, as we find that only half of them are self-motivated; this can make it challenging for HEI management and national policy makers to set up an appropriate external motivation system. Slovak national education policymakers should provide innovative ways to increase the development of digital competencies in higher education institutions through the Recovery Plan for Europe; additionally, providing investment in technology related to improved educational outcomes and the development of sustainable innovation in higher education will all help to raise the standard.

5-1-Recommendations for Future Research

The study is a stimulus for the further study of a wider range of topics appertaining to the teaching of university students, and especially a stimulus for increasing the quality of the university's educational environment. Future studies may replicate this research, not only to compare the results, but also to investigate a larger sample. It could include the use of DigCompEdu Check-In self-assessment questionnaires to be completed by, in particular, higher education lecturers. Additional research could be conducted to investigate the practical functioning of ICT in higher education as a content carrier. Furthermore, an examination of the real level of students' and lecturers' digital competencies is merited, and a description of the readiness of graduates in the context of the needs and requirements of practice in terms of the quality of digital competencies could also be explored. There is still scope for future research to develop instruments for lecturers' motivation that could facilitate an in-depth understanding of lecturer motivation from various perspectives. The application of theories concerning motivational processes to further education should be tested and supported by more empirical studies in the future.

6- Declarations

6-1-Author Contributions

Conceptualization, T.Š.Z and E. J.; methodology, M.T.; software, T.Š.Z.; validation, M.T., T.Š.Z. and E.J.; formal analysis T.Š.Z and E.J.; investigation, T.Š.Z and E. J.; resources, M.T.; data curation, T.Š.Z and E. J.; writing—original draft preparation, T.Š.Z. and M. T.; writing—review and editing, M.T.; visualization, E. J.; supervision, M.T.; project administration, T.Š.Z and E. J. All authors have read and agreed to the published version of the manuscript.

6-2-Data Availability Statement

The data presented in this study are available in article.

6-3-Funding

The authors received no financial support for the research, authorship, and/or publication of this article.

6-4-Ethical Approval

The study was conducted in accordance with the Declaration of Helsinki and approved by the Ethics Committee of the University of Ss. Cyril and Methodius, Trnava, Slovakia (ref. nr. UCM-FF-DE 320/2021, 8th of February 2021) and the Slovak University of Agriculture in Nitra (protocol code SUA 13_2021 approved 18th February 2021).

6-5-Conflicts of Interest

The authors declare that there is no conflict of interests regarding the publication of this manuscript. In addition, the ethical issues, including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, and redundancies have been completely observed by the authors.

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Appendix I

Questionnaire

Dear colleague, we kindly ask you to fill in the anonymous questionnaire. The results will be used to evaluate the needs of university lecturers in the field of pedagogical competence development. The purpose of the survey is also a retrospective evaluation of the Course in Academic Teaching you have completed. Select the most suitable answer from the options or write your answer in the appropriate place.

Faculty:

Male - Female

1) Your previous pedagogical education (before completing the Course in Academic teaching):

- Supplementary pedagogical studies
- Completed teacher study program
- None
- Other

2) My motivation for completing the Course in Academic teaching was:

- Requirement of the Head of my department
- Condition for the staff selection procedure
- My own interest
- Other

3) I currently feel my weaknesses in the area of (possibility of choosing multiple answers):

- Pedagogical communication with students
- Work with ICT in teaching
- Development of study materials for students
- Applying a variety of teaching methods
- Creating didactic tests
- Evaluation of student results
- Other

4) I would voluntarily choose further education in:

- Pedagogy
- Psychology
- ICT
- Foreign languages
- Professional field specialization
- Other

5) I have enough opportunities to develop my pedagogical competencies

- Yes
- No
- Partially

6) I have enough resources to study higher education pedagogy issues

- Yes
- No
- Partially

7) There are obstacles in my pedagogical development in:

- Lack of time
- Lack of educational offers
- Financial expenses
- None
- Other

8) I think the Course in Academic teaching is:

- Of no use
- Partially beneficial
- Very beneficial

9) The Course in Academic teaching at SUA met my expectations

- Yes
- No
- Partially

10) On completion of the course I felt I had learned how to teach

(choose your answer at scale from 1 to 5; 1= not at all; 5= definitely yes)

1 2 3 4 5

11) Completing the course led to the fact that I gained knowledge about new trends in education

(choose your answer at scale from 1 to 5; 1= not at all; 5= definitely yes)

1 2 3 4 5

12) Completing the course led to the fact that I met new people

(choose your answer at scale from 1 to 5; 1= not at all; 5= definitely yes)

1 2 3 4 5

13) Completing the course led to the fact that I learned to manage problematic situations in class

(choose your answer at scale from 1 to 5; 1= not at all; 5= definitely yes)

1 2 3 4 5

14) Completing the course led to the fact that I increased my chances of keeping my job

(choose your answer at scale from 1 to 5; 1= not at all; 5= yes)

1 2 3 4 5

15) Completing the course led to the fact that I received points for the position of associate professor

(choose your answer at scale from 1 to 5; 1= not at all; 5= definitely yes)

1 2 3 4 5

16) Completing the course led to the development of my pedagogical competencies

(choose your answer at scale from 1 to 5; 1= not at all; 5= definitely yes)

1 2 3 4 5

17) Completing the course led to the development of my self-reflective and self-developmental competencies

(choose your answer at scale from 1 to 5; 1= not at all; 5= definitely yes)

1 2 3 4 5

18) The course developed my communication and interpersonal skills

(choose your answer at scale from 1 to 5; 1= not at all; 5= definitely yes)

1 2 3 4 5

19) The course broadened my general outlook in various areas

(choose your answer at scale from 1 to 5; 1= not at all; 5= definitely yes)

1 2 3 4 5

20) If the course I completed was implemented only on a voluntary basis, I would have participated in it anyway

- Yes
- No

21) I evaluate the publication output from the course as (possibility of choosing multiple answers):

- Useful for my publishing activity
- Useful for my teaching activity
- Not of any use
- Suitable, but with some of my personal comments
- Other

22) Your suggestions, comments and recommendations for future courses: