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Research and Innovation in Vocational Teacher Education at the University of Sopron

Abstract

Information and communication technology (ICT) is a major challenge for today's education systems. A research project by the Benedek Elek Faculty of Pedagogy (University of Sopron, West Hungary) examined the digital skills of vocational school teachers. Based on these research results, which resulted from a questionnaire survey and qualitative interviews, the curriculum of vocational teacher training was renewed three years ago. The main goal of the curriculum reform was to better prepare students for digital challenges. For this reason, two new courses, digital pedagogy and ICT methodology in vocational training, have been introduced in vocational teacher training. This study presents the previous research and another micro-research that dealt with the question of the extent to which teachers can use the digital skills (tools, methods, teaching materials) acquired at the university in a targeted manner in schools. The data this micro-research were collected by using a questionnaire

Keywords

Introduction

In our study, we undertook the task of introducing how the vocational teacher training at the University of Sopron aimed to overcome the challenges raised by information society and digitalisation. The predecessor of the University of Sopron was the Vocational School of Mining (Bergschule, Mining Academy, since 1763), founded in 1735 at Selmecbánya (Schemnitz, today Banská Stiavnica, in Slovakia) (Zsámboki, 1985). After World War I, the college was moved to Sopron (Hiller, 1992). The first occasion when the institute took the name "University of Sopron" was after the change of regime (200 Years of Tertiary Education of Forestry,

2008). The university currently operates with four faculties (forestry, timber industry, economy and pedagogy). Until 2000, the Benedek Elek Faculty of Pedagogy operated as an independent Vocational High School (Patyi, Sarkady & Simon, 2009). The training of vocational teachers at the University of Sopron started in 1992. In the beginning, the training of engineer-teachers and agricultural engineer-teachers was implemented as a post-graduate course following vocational studies, and later also in parallel with them; however, from 2006, following the introduction of Bologna Process teacher training, it has been implemented as MA-level training that follows the completion of engineering, agricultural engineering and economist studies.

Following this, we present a piece of research that the authors of this study conducted in 2015 in the vocational training institutions of the Western Transdanubia region of Hungary. Among other things, the research aimed to reveal the digital competences of the vocational pedagogues who worked in these schools. We examined how frequently and by what methods vocational pedagogues use ICT tools in education.

Based on the outcomes of the research, in 2017, we reformed the curriculum of vocational teacher training. In the following parts of our study, we aim to introduce those elements of the reform (the introduction of two new courses) that served the extension of the students' digital competences and the impartation of digital pedagogic methods.

At the end of our study, we then introduce a micro-research that was conducted among our graduates. In line with the traditions of Hungarian vocational teacher training, besides conducting their studies, a significant proportion of our students in teacher education also work as teachers in a vocational school. In the course of the research, we sought to discover to what extent and how they put into practice the digital education methods and options that they have acquired at the University.

In the course of the regional survey preceding the reformation of the curriculum, we aimed to measure the competences of vocational pedagogues by using the methods of written (questionnaire) and oral (interview) inquiry. In the research amongst students, we used the method of written (questionnaire) surveying. The processing of the vocational literature background and the description of the curriculum reform was implemented by the method of document analysis (Falus szerk, 2004).

Theoretical background

We live in an informational or, in other words, knowledge-based society. Nowadays, the main phenomenon of the rapid technological development that has been continuously present since the beginning of the industrial revolution is digitalisation. The pace of development is extremely fast, accompanied by a

radical transformation of the culture. The process of digitalisation has an impact on the way of life, the economy and also, of course, on educational systems (Molnár & Orosz, 2020).

Today, the majority of people use smartphones, and our everyday life is more and more dominated by a plethora of smart devices. Following the millennium, the model of "Homo Informaticus" was created, who spends an extraordinary amount of time at computers in continuous need of new information, and whose mental information processing ability has accelerated, accompanied by a strong transformation of mentality and communication (Buda, 2013). For today's economic experts it is evident that one of the determinative elements of economic growth is the human factor. The proper operation of an economy is impossible without a well-trained workforce possessing digital competences (Balogh, Molnár, Nagy, Orosz & Szűts, 2020). At the beginning of the new millennium, the decision makers of the European Union also discovered the connections between the progress of an economy and a well trained workforce equipped with digital competences. In the spring of 2000, the European Council designated the establishment of a competitive, knowledge-based economy as an essential objective. At the Lisbon session of the Council, it was affirmed that the essential skills and competences that are necessary for life-long learning have to be defined within a European framework. The EU recommendation was finally published in 2006, in which the European Union pronounced digital competence to be one of the eight key competences that are necessary for life-long learning (Balogh, Molnár, Nagy, Orosz & Szűts, 2020; Europäische Gem. 2007). As defined by the European Union, "digital competence involves the confident, critical and responsible use of, and engagement with, digital technologies for learning, at work, and for participation in society" (European Commission 2019).

Information society and digitalisation present challenges for educational systems (Katona, 2015). An important task of public education is to equip students for the information society of the new millennium. Informal knowledge, tools, and a culture of communication have to be made available for every student. Children and young adults have to be prepared to live, work, create, study and learn to be entertained as adults in an age of information. At the same time, if we narrow our focus to the Hungarian context, the task of equipping youth for the challenges of the future is assigned to an education system in which the necessary conditions are not always present. The appropriate tools of education are not always available, and not every pedagogue possesses adequate digital competences. Contemporary youth are "digital natives"; however, the majority of pedagogues (those above 40 years old) are considered to be "digital immigrants". While the life of the students has been saturated by digitalisation since their birth, part of the pedagogues' society has to acquire the use of digital tools as an adult (Molnár & Orosz, 2020). These generational differences can create a digital gap between students and teachers which can lead to a role tension in pedagogues: teachers

sometimes have to ask for the help of students, who solve digital assignments faster and more easily (Szabó, 2015).

Teaching and learning both went through transformations in the digital age. Traditional pedagogical tools and methods are less and less efficient; however, the use of the new technique offers new learning-teaching opportunities. The characteristics of learning are transformed, and the abilities and competences that enable the efficient classification and use of knowledge, as well as problem solving, became highly valuable. Knowledge is constantly renewed, just as are the ways of accessing information. The role of school and pedagogues has also changed: they are not the exclusive mediators of knowledge anymore; their main task is to create a learning environment that motivates and activates students, and encourage discovery, creativity, communication and cooperation. Today, the integration of ICT tools into the learning process is a definite requirement for pedagogues. Pedagogues have to be well-oriented in the digital world; they have to teach how to use ICT tools for learning purposes, how to seek out and use information in a critical manner and what are the etiquette rules of the internet. These new roles can only be completed with an open-minded approach towards new tendencies and new pedagogical practices (Molnár & /Orosz, 2020). Today, the use of digital pedagogic methods is indispensable for the development of digital and other basic competences.

Regarding our subject, vocational teachers are also in a special situation amongst pedagogues. While the teachers who teach common subjects learn to teach one, two or maybe three subjects during their high school studies, vocational teachers are required to have comprehensive knowledge of about 8-10 subjects. Traditional, printed textbooks or other teaching materials are only seldom available. Undoubtedly, vocational training has the closest relationship with economy (industry, agriculture, trade); thus, due to the fast changes of economic life, the teaching materials, educational technologies and applied methods are also renewed here first. Hungarian research outcomes also confirm that vocational teachers are amongst the leading participants in the educational use of modern technologies (Buda, 2013).

Of course, the information society and the process of digitalisation has not only raised challenges for public education but at the same time for teacher training, too. The preparation of teacher candidates for the transformed role of pedagogues and the methodological use of ICT tools in the process of learning and teaching is the responsibility of teacher training institutions. Beyond the knowledge of digital pedagogical methods, the positive attitude that is indispensable for the use of ICT tools and methods, as well as an open perspective for change, has to be developed in the course of teacher training (Szabó, 2015).

Investigation of the digital competences of vocational pedagogues

In 2015, a research team was formed by the authors of this study at the Benedek Elek Faculty of Pedagogy of the University of Sopron. The team conducted a survey amongst the pedagogues in the vocational schools of Western Hungary. In the course of the survey, we chose three competences that have special significance in vocational education from the list of "Obtainable teaching knowledge, abilities and attitudes" included in Annex II to Ministry of Human Capacities Decree 8/2013 (8/2013 EMMI rendelet 2. melléklet; Patyi, Kollarics & Katona, 2015). One of the basic questions of the survey was to find out what kind of digital competences vocational pedagogues possess (learning support field of competence). According to the above-mentioned teacher training decree, the graduated teacher "is able to use traditional and information-communication techniques and digital teaching materials efficiently and professionally" (8/2013 EMMI rendelet 2. melléklet).

After considering the purpose and the type of the research, we chose the method of surveying. Due to the divided nature of the target group (pedagogues and school principals), the use of two different methods seemed to be appropriate: the method of written surveying amongst pedagogues, and oral interviews amongst principals. Our research covered the Western Transdanubia region of Hungary (Győr-Moson-Sopron, Vas and Zala counties), which is also the catchment area of the University of Sopron. In terms of vocational orientation, according to the training palette of the university, we chose the institutions that belong to the agricultural, economic (trade marketing), and wood industry fields of profession. In these training areas, all institutions were selected (32 high schools). The sample element number of the questionnaire survey was 250 individuals, and the sample element number of the principal interviews was 31 people (Patyi, Kollarics & Katona, 2015). We did not receive feedback from any institution apart from one.

The learning support field of competence was investigated by questions 8-14 of the questionnaire, including the investigation of digital competences (use of ICT tools, its frequency, intensity and preferences) by questions 8, 9, and 10. Question no. 8 dealt with the use of tools and its frequency. The distribution of the replies showed that the daily use of traditional tools (blackboard and chalk) dominates, but the over 60% daily frequency of ICT tools implies that vocational pedagogues also use this optional educational technique routinely (Figure 1.). The rate of those who never used modern ICT tools is below 5% (4.9%) in the whole sample (Patyi, Katona & Kollarics, 2016).
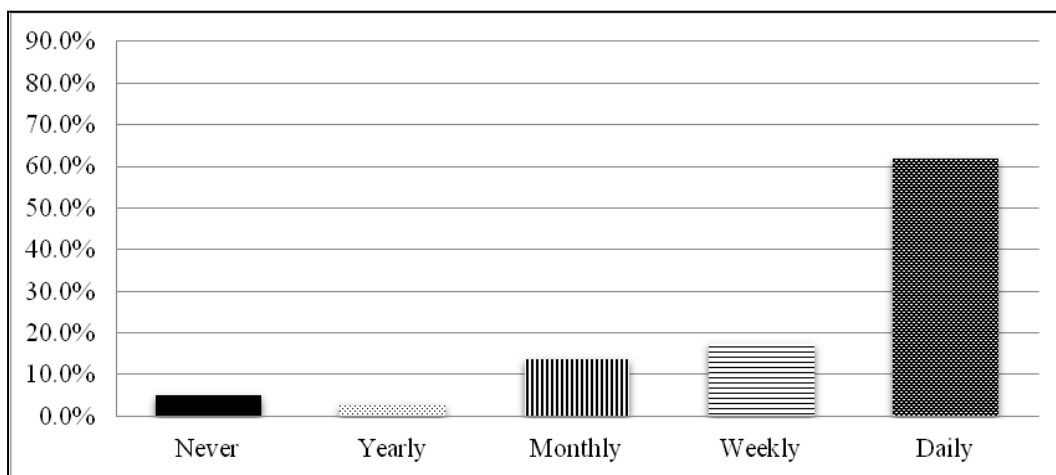
Figure 1: How frequently do you use ICT tools in the course of the teaching of your vocational subjects? (N=247)

Question 9 of the survey, through identification with five statements on a scale of 1 to 6, among others, investigated the existence of substantive e-learning materials, too. 31.4% of the respondents indicated values of 5 or 6, which signifies that almost 70% of vocational pedagogues do not use e-learning educational forms. The replies are consistent with the outcomes of principal interviews since none of the principals mentioned the existence of an e-learning framework in their school. Of course, it does not deny the existence of such, it signifies instead that if there are any e-learning frameworks, they are not yet connected to the pedagogic practices of the school in an organic manner (Figure 2.) (Patyi, Katona & Kollarics, 2016).
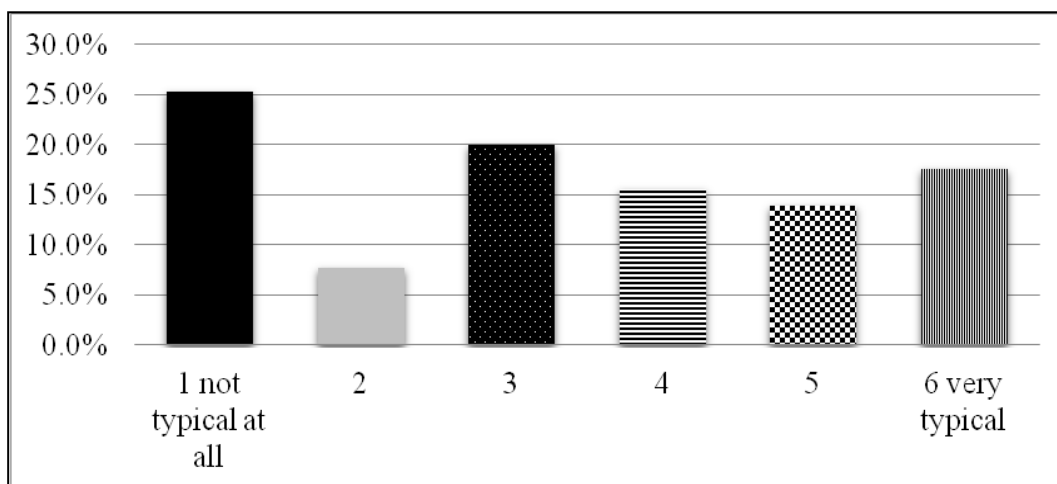

Figure 2: Do you have your own e-learning teaching materials? (N=245)

More than 40% of the pedagogues refused to include mobile phones in education. However, the rate of those who chose scale values of 4 to 6 – meaning that they are not totally unwilling to do so – is close to one quarter of the pedagogues (23.7%) (Figure 3.).
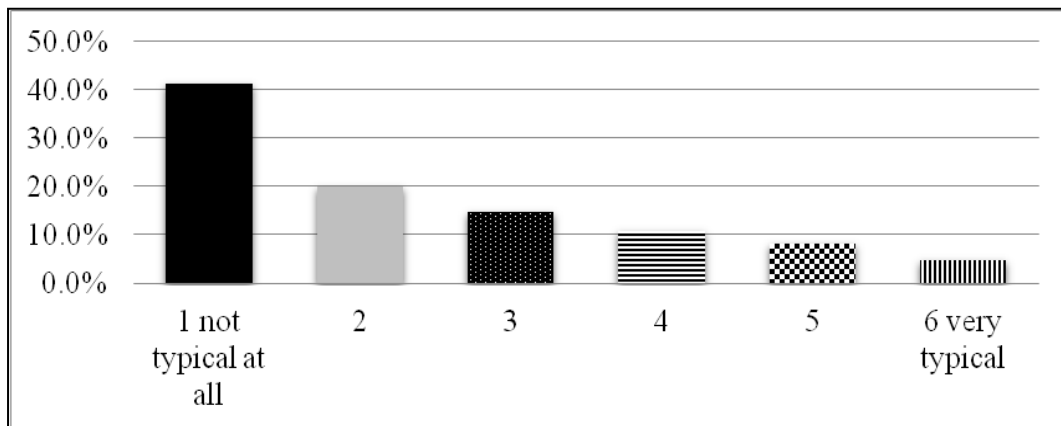
Figure 3: "I think it is a good idea to include the students' mobile phones in education" (N=249)

Question 10 also investigated the use of ICT tools, but here we asked the participants to rank the different tools according to the frequency of their use. The outcome of the sub-question "do you use ICT tools or not" is clear; more than 90% of the respondents confirmed that they use such tools (without exception, all of the respondents under 40 years of age use ICT tools). Here, "1" indicated the most frequent, and "5" indicated the rarest use on the questionnaire. According to the outcomes, the trend is clear: personal computers are mentioned most often, followed by data projectors; thus, projected presentations rule over this area. It is noteworthy that interactive whiteboards are used almost as often as data projectors; however, tablets and smartphones do not constitute a part of the everyday life of vocational education (Figure 4.) (Patyi, Katona & Kollarics, 2016).
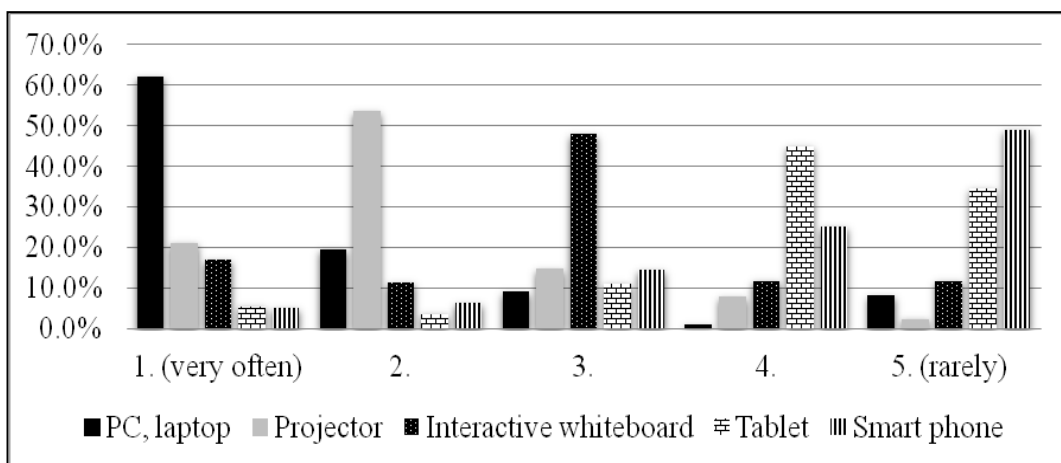

Figure 4: Rankings of ICT tools according to the frequency of their use (N=211)

According to the interviews conducted among school principals concerning the existence and the use of Information and Communication Technology (ICT), we can establish that the necessary conditions are present at the majority of the

locations; the basic toolkit consisting of notebooks and overhead projectors are available for vocational pedagogues. Interactive whiteboards are also often present and, if necessary, the schools also possess special vocational software (e.g. CAD software in wood industry vocations). The school principals frequently mentioned, however, that the tools are usually acquired through tenders or nonrecurring support sources but there are no sources for their maintenance, upgrade, replacement, and renewal. According to the observations concerning principal interviews, we can establish that ICT is present in the vocational training of the region; vocational pedagogues take advantage of this opportunity and pursue the extension of their pedagogic toolkit with this technology; however, the complete range of included possibilities is far from being completely exploited. (Patyi, Katona & Kollarics, 2016).

Curriculum reform – transposition of research outcomes into training practice

In 2017, due to the legislation changes of "Training and output requirements" concerning vocational teachers, the renewal of vocational sample curricula also became necessary at the University of Sopron; thus, it became highly relevant to transpose the empirical research outcomes described in the previous chapter into the sample curricula of our vocational teacher faculties (agricultural engineer-teacher, engineer-teacher, economist teacher) and at the same time into training practice. One of the main purposes in the course of curriculum reform was to aid our students to more easily overcome digital challenges. For this purpose, we introduced two new courses (digital pedagogy, and ICT methodology in vocational training) into vocational teacher training, while the knowledge acquired during the digital pedagogy curriculum also became a required part of the comprehensive vocational methodology exam in order to reinforce this area. Further on, we encouraged and encourage the use of digital education systems and contents into the course of teacher training.

The course called "digital pedagogy" spans one semester in the present correspondence-based teacher training, containing eight theoretical lessons and eight practice sessions and by its completion, the students earn four credit points. The purpose of the course is to equip the students with up-to-date ICT as well as demonstrating the impacts of their use on the teaching-learning process. Another purpose is to motivate the students towards a "digital perspective" and a modern pedagogic approach. The course enables the processing, by the use of a modern toolkit, of vocational literacy content that develops in the course of vocational training, as well as the discovery of methodological options concerning the use of ICT tools, and the creation of respective e-learning materials. The course runs in a blended learning educational format (eight hours offline, eight hours online with the help of Moodle e-learning framework). The semester concludes with the creation of a substantive digital curriculum, which is evaluated with a grade.

The "ICT methodology in vocational training" course contains sixteen practice sessions, and by its completion, the students also earn four credit points. Its purpose is to introduce the possibilities, advantages and limitations of modern pedagogy, as well as their practical execution in vocational training, with a special focus on the digital curricula that can be operated in an e-learning framework that fits the vocational area of the given skill and the gamification possibilities that can be applied there. Similarly to the "digital pedagogy" course, it is also executed in a blended learning educational format (eight hours offline, eight hours online with the help of Moodle e-learning framework). At the end of the semester, the students have to prepare a curriculum and lesson outlines that are renewed by digital methodology in order to successfully complete the course.

Micro Research

The first classes of students who studied according to the renewed curriculum of the vocational teacher training programme finished their studies in 2018/2019. The main goal of our micro research conducted among them was to gather their opinions on the renewed curriculum and on its digital pedagogical block and the usefulness of the acquired knowledge in the everyday pedagogical practice.

In these two years, 29 students completed the training programme. We sent a questionnaire to them with the request that it should be filled in only by those who currently practice their profession. The interviewing method would have been more suitable for conducting the survey, but there were technical obstacles to doing so: our students were not available personally due to long distances; therefore, we decided to communicate via e-mail (the situation was exacerbated by the pandemic during the micro-research). Finally, 10 vocational teachers sent us back the completed questionnaire. Based on this small sample, although it covers more than 30% of the graduates, the research cannot be considered representative; however, it can be a good indicator of whether the directions of the changes made in the curriculum serve our pursued objectives.

In the questionnaire, we expected answers to the following questions:

1. To what extent were their pedagogical competences enhanced by the teacher training programme?
2. To what extent were their digital competences enhanced by the digital subject block of the training programme?
3. Were their outlook and attitudes to the information society and the new digital generation changed by the digital subject block of the training programme?
4. Could they make use of the knowledge acquired during the digital subjects in their pedagogical practice?

5. We asked them to mention some examples when they could make use of the knowledge acquired during the digital subjects in their pedagogical practice.
6. We asked them to give us some suggestions for improving the digital educational contents of the teacher training programme.

The answers to the first four questions had to be given on a scale of 1 to 6.

The collected data showed that the former students were satisfied with the usefulness of the teacher training programme. Figure 5 shows that they feel the programme enhanced their pedagogical competences significantly (average value: 5.5).
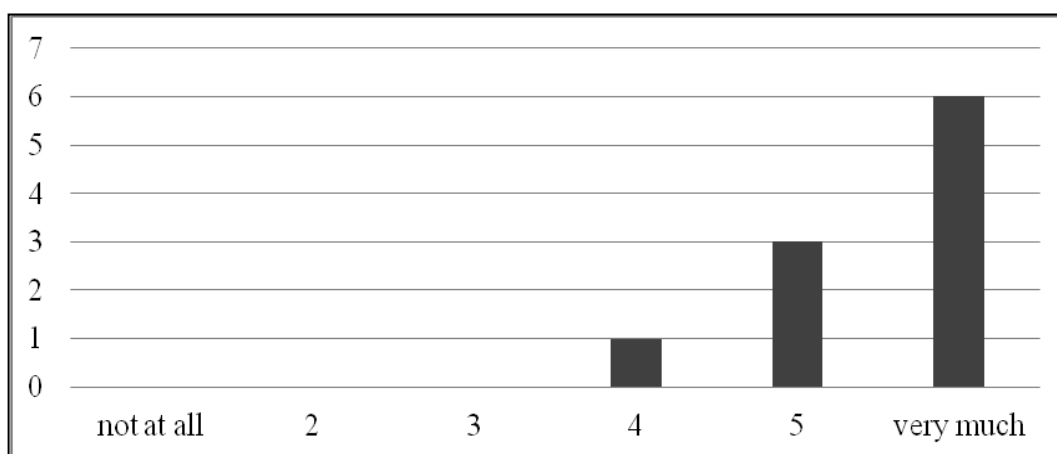

Figure 5: Improvement of pedagogical competence after completing the vocational teacher training programme

According to the majority, the digital subject block improved their digital competences (average value: 4.9) and influenced positively their attitudes to the new generations (average value: 4.9). Most of them could make use of the learned digital methods in their pedagogical works (average value: 4.8).

Our former students mentioned many examples of digital tools used in their own practice.

They mentioned the following programmes, applications and e-learning systems of their own practice:

• Moodle e-learning system
• Google Classroom,
• Kahoot,
• Redmenta,
• Quizlet,
• Discord,

- Okosdoboz (Hungarian edutainment portal),
- Tankocka (Hungarian learning apps portal)

They mentioned that these applications, portals and systems made their pedagogical work more colourful and effective and shaped their approaches.

One of the students wrote the following about how her outlook was changed by the teacher training programme:

> "I feel myself closer to the thinking, motivations, learning habits and methods of the digital generations and it became an important approach of the organisation of my pedagogical work."

Many students mentioned that they could make good use of their digital knowledge acquired during the courses during the period of online teaching forced by the pandemic.

This feedback also mean that the digital block accomplished its purposes.

Graduates also made suggestions for further development of methodology and content of the digital subjects.

Most of the suggestions were aimed at strengthening the practical side of the subjects: they want to have more experience with using digital programmes, applications and e-learning systems to make their pedagogical tools even richer.

Based on the student suggestions received during the micro-research, the content of the theoretical part within the subject "Digital Pedagogy" was modified: the issue of digital generations was given stronger emphasis. In the practical part of the subject "ICT methodology in vocational training", we have included the description of the portals and services requested by the students: Mentimeter, Kahoot, Quizlet, Google Classroom, Redmenta, MS Teams, Zoom and Webex. The curriculum was not modified.

We are planning further research with a larger sample (the number of graduates has since expanded) and an expanded scope to get a more accurate picture of the expectations and satisfaction of students practising their teaching profession.

The relevance of micro-research is limited, mostly indicating that the training institution has taken the first steps in this direction and the feedback is encouraging. The relevance of this research to other institutions is that it is worthwhile to break into this educational innovation.

Summary

Living in an information society, we have to apply new pedagogical methods for effective teaching of new digital generations. It is for this that we need to prepare the vocational teachers of the future.

We therefore transformed the content and methodology of the vocational teacher training programme at the University of Sopron by relying on our earlier research results which examined the existing educational methodology experiences and the digital competences and possibilities of teachers in the Hungarian vocational training system.

During the transformation process of the curriculum, we created a new digital subject block which contains theoretical and practical knowledge and helps to develop the students' digital competences and form their attitudes. The results of the micro research conducted among the first graduated classes are encouraging.

They indicate that our changing direction of the renewed training programme is good; the graduates can make effective use of the knowledge acquired during the training programme. At the same time, the results also show that there are many tasks to be carried out in order to improve the content and practical side of the new digital courses.

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