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The factors which influence the continuance intention of teachers in using the interactive digital identification key for trees in elementary school science education

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Abstract
It is hard to imagine biology education without the identification of the species of interest, mostly with the implementation of a dichotomous key. Digital identification keys (DIKs) have been developed and made available to teachers in Montenegro. We investigate the factors, which influence teachers', who had applied the DIK, in their continuing intention to use them in primary schools. The modified unified theory of acceptance and use of technology (UTAUT), continuance theory, and expectation-confirmation Theories were used for the identification of the factors which influence the teachers' decision about whether to continue to use the DIK. 232 teachers from Montenegro participated in this research. The results indicate that the perceived pedagogical impact and user interface quality has the greatest influence on teachers' continuance intentions (CIs). Performance expectations, effort expectations and technical compatibility have a moderate influence and management support, personal innovativeness and students' expectations have a low influence on teachers' CI of using DIK.

Keywords: digital dichotomous key, continuance intention, UTAUT, plant, primary school

INTRODUCTION AND LITERATURE REVIEW

Nature and environmental protection are among the main contemporary challenges we face. Human impact on the natural world is so significant, that the term "anthropocene" has been coined, recognizing humans as a geological force (Crutzen, 2006; Lewis & Maslin, 2015). Therefore, searching for solutions to stop or even reverse these devastating trends is a pressing need. The United Nations (2015) have determined the sustainable development goals (SDGs) in order to establish a set of effective organizing principles for sustainability, which incorporate nature and environment protection as one of the main objectives. There is a growing perception that the key to addressing these problems should be sought in education, particularly by the application of methods and strategies which address not only knowledge but also emotions and attitudes. In the toolbox of environmental education, such strategies include field and laboratory work that are hard to imagine without identifying the species of interest (Randler, 2008).

One of the main problems in nature protection is biodiversity loss (Roe et al., 2019). However, not all species and aspects of biodiversity protection are given equal attention and importance. For example, the protection of plant diversity has received less attention than the protection of animal diversity (Goettsch et al., 2015). Nonetheless, research indicates that plants are correlated with almost all SDGs and that flora should be natural resources that contribute to the achievements of those goals, and a better sustainable future (Amprazis & Papadopoulou, 2020). The same authors gave examples of how some of the plants can help achieve the SDGs, such as crop plants contributing to SDG 1 (no poverty). Moreover, trees have a special significance in their contribution to achieving a range of SDGs. Trees are woody perennial plants with a clearly defined above-ground stem and crown. They are extremely important to ensuring a healthy environment and human well-

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Contribution to the literature

- The results of this study point out that Perceived pedagogical impact (PPI) and User Interface Quality (UIQ) have the most significant influence on (Continuance Intention) CI among teachers regarding using the Digital identification keys (DIKs) in teaching.
- Performance expectations (PE), effort expectations (EE), and technical compatibility (TC) have a moderate influence on teachers' CI about using the DIK.
- Teachers believe that using a DIK in biology education influences students' positive opinions about plants, and DIKs implementation in teaching and learning could be used to prevent plant blindness among the students.

being, while they provide oxygen, improve air quality, contribute to climate amelioration, conserve water, preserve soil, and support wildlife (Nowak et al., 2006, 2018; Turner-Skoff & Cavender, 2019). According to the research by Amprazis and Papadopoulou (2020) and Turner-Skoff and Cavender (2019), trees provide direct and indirect benefits related to the following SDG:

1. Goal 1: No poverty through providing many resources, such as materials, to a community;
2. Goal 2: Zero hunger- through the provision of fruit trees;
3. Goal 3: Good health and well-being- through reducing pollution;
4. Goal 4: Quality education, students' stay in a forest environment reduces stress and increases concentration; and
5. Goal 13: Climate action through storing and sequestering carbon; to mention only a few examples.

Trees are a specific group of plants because they are often the habitat of many other organisms such as mosses, ferns, lichens, birds, and so on. The identification of basic plant species in their environment is necessary for people to understand the importance of plant diversity, understand global environmental changes, and the urgency in the preservation of biodiversity (Silva et al., 2011). Flannery (2001) pointed out that plant species identification is an important skill for everyone who wants to understand nature and living beings' features at the molecular or ecology level. The identification of basic plant species and their classification is important because these skills contribute to people's understanding of plants and of their importance to biodiversity, the identification of plant species contributes to the orientation of people in nature, including better distinguishing landscapes, as well as contributing to connecting people with nature, its conservation, and its sustainable use (Nesbitt et al., 2010; Palmberg et al., 2015).

Although the importance of plants and their identification is clear, they do not attract the attention of students to the same degree, which often causes a phenomenon called *plant blindness*. Some of the main characteristics of *plan blindness* are the students' inability to recognize the basic plant species in their surroundings; their inability to understand the importance of plants to the environment; a failure to understand the process of matter circulation, the lack of development of positive emotions towards the natural environment and so on (Amprazis & Papadopoulou, 2020; Attenborough, 1995; Balick & Cox, 1999; Frisch et al., 2010; Pany, 2014; Remmele & Lindemann-Matthies, 2018; Wandersee & Schussler, 2001).

The solution to *plant blindness* and its prevention should be sought in the enhancement of teaching students about plants and their protection in an engaging way. To be effective, such teaching should provide engaging first-hand experiences, with a preference toward inquiry- and research-based activities with and about plants (Kirby et al., 2008; Patrick & Tunnicliffe, 2011; Uno, 2009). To connect plants with biodiversity, one of the basic skills that should be achieved is the ability to identify the plant species of interest. The importance of skills for species identification has been stressed in much previous research. The ability to identify different species is related to the student's positive attitudes toward them, developing awareness about the importance of species protection, increasing students' interests in nature, and recognizing protected areas, as well as using natural resources in a sustainable way (Aldhebiani, 2018; Hooykaas et al., 2019; Lindemann-Matthies, 2005). The traditional methods of plant identification are dichotomous and picture identification keys in both paper and interactive formats, the last of which is most often available online (e.g. the Key to Nature, n. d.). There exist a great number of published papers (e.g. Anđić et al., 2018; Drinkwater, 2009; Farr, 2006; Silva et al., 2011; Stagg & Donkin, 2016) that have offered arguments for the application of digital identification keys (afterward DIK) as one of the solutions which can help in decreasing plant blindness and increasing students' knowledge about plants and/or their motivation to learn about flora.

The implementation of technologies in education mostly depends on the teachers (Kafyulilo et al., 2015). Therefore, it is important to explore how teachers perceive the usability of a given DIK and what factors influence forming their continuance intention (CI) in terms of using them in their teaching. Most often studies have examined the differences between users and non-users in the early adoption phase (Taylor & Taylor, 2012) with the intention of lowering the number of non-users, while largely neglecting the group of users who tried the technology and later abandoned it. According to continuance theory and expectation-confirmation theory (Bhattacherjee, 2001a) and other models based on them (Chiu and Wang, 2008; Shin et al., 2011; Zhou, 2011) CIs are predictors of the continued usage of technologies. According to many researchers, CI could be used as a variable where technology is already introduced and users have some experience with it (Bhattacherjee, 2001b; Gefen et al., 2003; Hamid et al., 2016). To the best of our knowledge there is no published research which examines teacher intentions to continue using DIKs in biological education after the technology had already been tested.

The study employs constructs assembled from the unified theory of acceptance and use of technology (UTAUT) (Venkatesh et al., 2003) and technology continuance theory (TCT) (Liao et al., 2009) in combination with the expectation-confirmation model (ECM) (Thong et al., 2006), and other models obtained in research on CIs toward digital learning, such as those found in the studies by Lee (2010), Lin (2012), and Wang et al. (2012). The intention of the present study is to:

1. analyze and compare the factors which affect teachers intentions to continue using DIKs in teaching; and
2. develop an instrument that will allow the assessment of teachers intentions to continue using the DIK in follow up studies.

The DIK as a Learning Tool

Dichotomous identification keys are tools for the identification of organisms, during a process which is called identification. The educational strength of the keys is attributed to the finding that their application involves higher-order cognitive strategies, notably, analysis, synthesis, and evaluation (Šorgo, 2006). They could be in printed form as a book or script (sometimes digitalized) or in software (interactive) form as a digital application. DIKs are excellent identification tools for exploration in the field of systematic botany, inventory, and conservation (Brach & Song 2005; Dallwitz et al., 2000; Heidorn, 2001; Jarvie & Stevens, 1998). Dichotomous keys are an appropriate teaching tool that can be used to meet the principles of discovery learning, in which they bring effectively guides students through taxonomic identification by investigating existing information, discussing what is known and understood, and coming up with new ideas as conclusions (Papilaya, 2020; Roll et al. 2018). Andjic et al. (2020) pointed out that the application of dichotomous keys contributes to the constructivist teaching of biology, by encouraging learners to become more conscious of the difference between previously held ideas and knowledge and newly obtained knowledge by increasing cognitive dissonance. Stag et al. (2015) indicate that the DIK enables teachers to successfully achieve the activities proposed in the curricula, through inquiry-based learning in nature, which contributes both to students' knowledge and attitudes about nature. DIKs can be used in the education of students from primary school to university levels. Comparing the dichotomous keys which are used in the earlier phases of education with the keys used at the higher educational levels shows that the keys from the first group are very often adapted to the student and usually only the most commons species from the students' surrounding are included (Bajd et al., 2002).

The findings of a number of studies (e.g. Anđić et al., 2018, 2020; Silva et al., 2011) indicate that digital interactive dichotomous keys are better learning tools than printed non-interactive dichotomous keys. Silva et al. (2011) reported that high school students achieved better knowledge about the identification of plant species when using DIKs on tablets and computers. The finding of the same study was that the implementation of an interactive digital key caused more positive opinions about the process of plant identification than the printed alternative. Stagg and Donkin (2016), on the basis of research with biology students and enthusiast (amateur) botanist, concluded that the DIK is easier for navigation and handling during fieldwork than the printed dichotomous key. Jacquemart et al. (2016), developed a DIK and tested its contribution to students' knowledge in their botanical exam and students opinions about plant identification at the university level of education. The results of this research indicate that the DIK caused increased positive opinions among students about plant identification as well as better student ability in terms of identifying plant species. Alongside research on students at the university level of education and the contribution of the DIK to their knowledge or opinions, some researchers have conducted analogue studies with students in secondary and primary schools. Laganis et al. (2017) explored the effectiveness of DIKs in outdoor and classroom plant identification by students in secondary schools. They concluded that the DIK provides to the students effective, interesting, experiential and convenient learning. The results of the same study indicate that use in outdoor or classroom learning contexts did not significantly affect the efficiency of a DIK, or their contribution to student knowledge. So, the DIK could be successfully implemented in both indoor and outdoor botany learning. Anđić et al. (2018) explored the contribution of digital and printed dichotomous keys to the botanical knowledge of students in primary schools. The results of that research indicate that the DIK contributed more to the students' knowledge at the cognitive levels of evaluation and synthesis than the printed version of identification keys. In that research students which used DIK for plant identification gained better knowledge and skill to compare the plant species, families, or classes, find the similarities and differences between them, and creatively use their acquired knowledge to formulate a new entity or to create a new idea than students who use printed versions of those keys. Andjić et al. (2019) pointed out the possibility of using the DIK as a teaching tool that could be used for the botanical education of blind and partially sighted students with an appropriate adaptation of the content. The positive influence of DIKs on the knowledge of primary school students has been confirmed in the identification of animal species, such as birds (Knight & Davies, 2014). On the basis of these references, it could be concluded that DIKs are valuable teaching tools. However, in many studies, authors have recommended additional research which will include both students and teachers from primary and secondary schools. Such studies are necessary before a final recommendation on the use of DIKs in education is provided (Anđić et al., 2018; Campbell et al., 2011; Jacquemart et al., 2016; Silva et al., 2011). The decision of using some kind of technology in the classroom is mostly up to teachers (Howard et al., 2015; Kafyulilo et al., 2015). So, research on the factors which affect a teachers' decision to apply technology in a classroom, in this case the DIK, is very important. This is the reasons why we decided to perform this study.

The Theoretical Background for the Construction of the Instruments

Instruments based on the UTAUT (Venkatesh et al., 2003) and expectation-confirmation theory (Bhattacherjee, 2001a, 2001b) are widely used in the exploration of a number of constructs affecting behavioral intentions as a predictor of actual behavior. On the other hand, the technology continuance theory (Bhattacherjee, 2001a; Liao et al., 2009) considered experienced users and their will to continue to use technologies. CI could be defined as "an individual's intention to continue using some technology or service after acceptance" (Bhattacherjee, 2001a).

There are many models which have been developed for measuring the acceptance and intention of use of technology in different areas (for a review see: Chroustova et al., 2015). The technology acceptance model (TAM) (Davis, 1989) is one of the leading paradigms applied in educational sciences to examine the acceptance of educational technologies by students and teachers (Granić & Marangunić, 2019). Based on a meta-analysis of research dealing with technology acceptance by teachers Scherer and Teo (2019), concluded that TAM represents a valid model of explaining technology acceptance. These authors also point out that the degree to which TAM explains teacher acceptance of technology and the relative importance of predictors varies across samples. In order to increase the research applicability of TAM, it has been improved and expanded many times, and, as a result, numerous TAMs have emerged, such as the UTAUT (Venkatesh et al., 2003). UTAUT mainly expands the list of variables that explain the acceptance of technology by teachers in comparison to TAM. A very important contribution to the applicability of the TAM/UTAUT model in the field of educational research was made by Mayer and Girwidz (2019) suggesting its integration with TPACK. However, according to Šumak and Šorgo (2016), no one single model is fashioned especially for educational technologies. Among the available models, the UTAUT model is more promising than the other proposed models for technology acceptance. According to the UTAUT, there are four main determining components which influence behavioral intention and actual behavior, as follows: performance expectancy (PE), effort expectancy (EE), social influence, and facilitating conditions.

UTAUT has been enriched with the addition of constructs rooted in other theories or developed for specific purposes by the authors of various studies. Besides the listed determining components, among others, perceived pedagogical impact (PPI), students' expectations, and attitudes should be considered latent variables (constructs) in both educational (Šumak et al., 2017) and non-educational contexts (Chang et al., 2007). Holzmann et al. (2018) modified UTAUT by integrating anxiety and attitude to examine teacher's behavior intention to explore the use of 3D printers in Austrian high schools. The results of that research indicate that PE, facilitating conditions, anxiety, and attitude toward using technology significantly affect the adoption and using of 3D printers in high schools. In the same research, EE and social influence did not affect behavioral intention (Holzmann et al., 2018). Šumak and Šorgo (2016) pointed out that social influence has a greater impact on behavioral intentions and PE more strongly affects attitudes toward behavior intention about the use of interactive whiteboards among teachers in Slovenia. Bardakci and Alkan (2019) concluded that PE most significantly and positively influenced the behavioral intentions of pre-service teachers to use IWBs in Turkey. Pynoo et al. (2011) examined the acceptance of a digital learning environment by secondary school teachers in Belgium. The results of that study prove that PE and social influence are the main predictors, while on the other hand, EE and facilitating conditions had a minor influence on accepting the digital learning environment. Birch and Irvine (2009) pointed out that EE surfaced as the only significant predictor of behavior intention around ICT integration in the classroom by secondary level pre-service teachers in Canada. In the research of Lin et al. (2013), the facilitating conditions factors and technical support availability were the most influential predictors as to a teacher's acceptance of podcasting as a teaching tool in the United States. Zhou (2011) in exploring mobile devices, added two constructs from flow theory to find that perceived enjoyment and attention focus have strong effects on user satisfaction, which in turn affects CI. As a conclusion, we can recognize that each emerging technology or application needs research into behavioral intentions in the context where is supposed to be actually used and regular follow-up studies on the CIs after the introduction of the application. Additionally a number of personal factors and traits such as gender, age, experience, and so on can be considered as moderators of the paths between constructs.

While there are a number of studies which have examined the acceptance and behavior intention of using some innovative education technology, there are incomparably fewer studies which examine CI in terms of their use. However, reviews of studies have shown that understanding the factors which influence the CI as regards an item of technology could contribute to the desired outcomes in education (Panigrahi et al., 2018). For example, Zhou (2011) used UTAUT to explore CI in the use of mobile internet in China. His results indicate that PE, social influence and facilitating conditions also affect CI. Lu (2014) concluded that PI (PI) has a strong influence on CI regarding mobile commerce. Legris et al. (2003) claim that PI influences the acceptance of using technology. Additionally, teachers' innovativeness has an effect on teacher attitudes toward the pedagogical impact of pedagogical and learning innovations (Valenčič-Zuljan & Vogrinc, 2010). Shin (2008) pointed out that the perception of quality has a strong positive impact on CI for the implementation of smartphones in teaching. Shin et al. (2011) concluded that employing perceived usability and perceived quality would be a worthwhile extension of UTAUT and expectation-confirmation theory in the implementation of smartphones in learning. According to Hart and Henriques (2006) and Iqbal and Bhatti (2016), implementation and CI in terms of digital learning at the university level of education depends on university and faculty support. The results provided by Joo et al. (2014), Shin et al. (2011), and Smet et al. (2012) indicate that service quality, content quality and user interface have a positive effect on CI for the implementation of smartphones in learning. However, there is not enough research which has explored the relationship between ease of use and moving through user interfaces and the impact of these factors on CI in digital learning (Hong et al., 2011; Yang & Shin, 2010). Chiu and Wang (2008) identified that PE, EE, and computer self-efficacy are significant predictors of individual intentions to continue using web-based learning. Moreover, in their research, social influence did not affect web-based learning CI. Panigrahi et al. (2018) proposed, on the basis of their research results, a model in which PE, EE, computer self-efficacy, attainment value, utility value, and intrinsic value were the main predictors for CI in relation to web-based learning.

On the basis of the literature review, it might be concluded that the UTAUT with enrichments from other theories has been successfully implemented in exploring teacher's intentions to use and CI towards the application of technologies in a digitally enriched environment. However, to the best of our knowledge, there has been no empirical study which has examined CI among teachers in using a DIK, which are widely used in biological education. This study seeks to fill this gap.

DIKs and the Montenegrin Education System

In this research, the teachers were asked about a DIK on trees which was published by the State Publishing House–Textbook and Teaching Aids, Podgorica, Montenegro. The DIK was approved by the Ministry of Education of Montenegro (2013) and recommended for use in the education of students in the fourth grade (approximately 10 years old) during the teaching about plants in their surroundings into the subject nature. According to the Montenegrin curriculum, students in this grade should learn about the most common trees in their surroundings. The DIK was created as supporting material to the textbook which is used in Montenegrin schools and which contains chapters about trees that are native to Montenegro. A link to the tool is provided at http://zuns.me/sites/interaktivni-materijal/drvece-oko-nas/. Because Montenegro is a mountainous country with about 60% forest coverage, the topic about trees and forests reflects that fact that this is an environmental issue as well.

The education system in Montenegro is organized into three levels: primary school, secondary school, and tertiary education. Six to fourteen year old children are enrolled in the obligatory nine years of primary school. Primary school is split into three separate three-year cycles (the first, second and third cycles). Classes in the first three-year cycle (grades 1-3) are taught by one classroom teacher of all subjects, except English which is taught by an English teacher. The second three-year cycle (grades 4-6) introduces subject teachers to teach art, music, and physical education. In the third cycle (lower secondary level in Montenegrin primary schools) the teaching is organized into subject teaching (every teaching subject has a different teacher). Upper secondary school is not compulsory and it is attended by the students who are between fourteen to eighteen-years-old, lasting between two (vocational schools) and four years (technical schools and the general academic secondary school called Gimnazija). Comparative public schools organize the teaching following the same programs and curricula approved by the Montenegrin Ministry of Education. After the *matura* exams (the final leaving exam), students in Montenegro can apply for higher education which is organized according to the

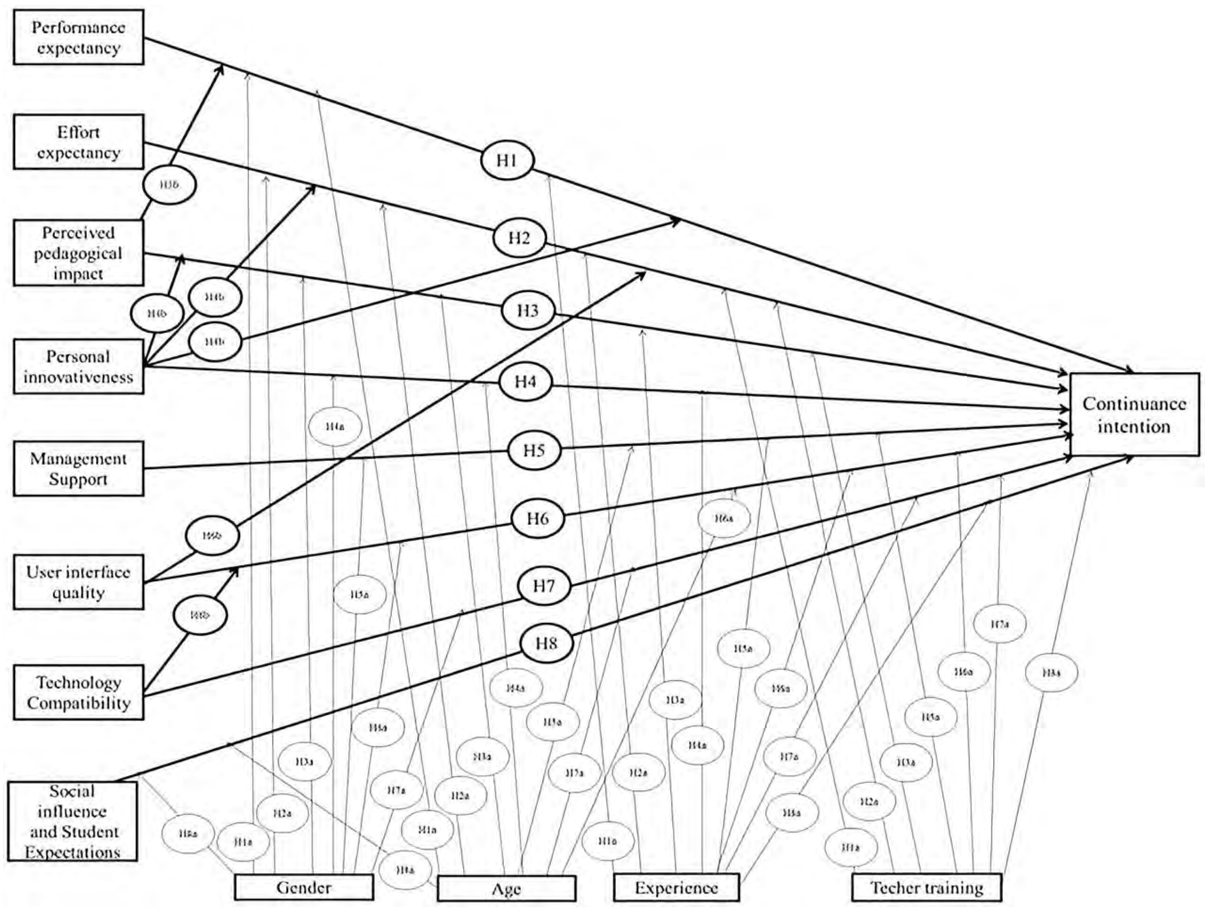

Figure 1. Research model and hypotheses in this study

Bologna system. In Montenegro, future teachers are educated at the state university, the University of Montenegro, at the Faculty of Teacher Education. In the second year and the third year of their degree, future teachers have a three-semester subject "methodology of teaching the natural sciences". In this course, future teachers in Montenegro are introduced to the basic species that make up the biodiversity of Montenegro, with special attention to plants species which include trees, as well as the principles of the functioning of dichotomous keys, and he identification of plants and animal species and their taxonomical belongs.

RESEARCH MODEL AND HYPOTHESES

The combination of two or more constructs from different theoretical models can provide a better understanding of what user expectations about certain forms of technology and their CI are (Pinpathomrat, 2015; Shin et al., 2011). This was the reasons why in this research, different constructs were selected from the UTAUT, the continuance theory and the ECM in the exploration of their predictive power of CI toward digital learning (Lee, 2010; Lin, 2012; Wu & Zhang, 2014).

In our model, CI is regarded as an outcome construct and eight constructs are considered predictors (**Figure 1**).

The Outcome Construct

Continuance intention

CI is, in our model, an outcome construct. Three variables of the construct are defined as individual beliefs and intention to continue using a specific item of technology (Bhattacherjee, 2001a; Shin et al., 2011). In the context of this research, CI is considered to be showing an intention to continue using the DIK as a teaching tool.

The Predictor Constructs

Performance expectancy

PE is the degree to which an individual believes that the usage of technologies improves performance (Venkatesh et al., 2003). In this research, PE is considered to be the belief of teachers that using the DIK will contribute to their teaching performance, through making teaching easier, by increasing the productivity of teaching, by increasing the effectiveness of teaching, and in terms of its general usefulness in teaching. As such, the following hypotheses are proposed:

1. H1: PE will have a significant influence on CI.
    a. H1a: Gender, age, experience and teacher training will moderate the influence of PE on CI.

Effort expectancy

EE is defined as the degree of the ease of use of technology by an individual (Venkatesh et al., 2003). EE is considered in this study to be the teachers beliefs about the ease of using the DIK in teaching, through easy and clear interaction with the DIK during the teaching; the ease of learning to use the DIK in teaching; the required time to become skilled in using the DIK in teaching and the general opinion about the ease of use of the DIK. As such, the following hypotheses are proposed:

1. H2: EE will have a significant influence on CI.
   a. H2a: Gender, age, experience, and teacher training will define the influence of EE on CI.

Perceived pedagogical impact

PPI is defined as the teacher's beliefs about the way in which technology can support turning their pedagogical-educational beliefs into classroom practice (Ertmer, 2005; Šumak et al., 2017). In this study, PPI is considered to be the beliefs of teachers about how the implementation of the DIK in the classroom can influence student academic achievements; students' motivation for learning; active engagement in the teaching process; the time which students spend in nature during their exploration and students' attitudes toward plants. On the basis of the above, we propose the following hypotheses:

1. H3: PPI will have a significant influence on CI.
   a. H3a. PPI will have a significant influence on PE.
   b. H3b: Gender, age, experience and teacher training will define the influence of PPI on CI and PE.

Personal innovativeness

PI is defined as the enthusiasm or willingness of an individual to accept and try out new technology (Lu et al., 2003, 2005; Venkatesh & Davis, 2000). In this research, PI is considered to be the teachers' beliefs about how much they like to experiment with new technologies and try out new teaching technologies. Therefore, the following hypotheses are proposed:

1. H4: PI will have a significant influence on CI.
   a. H4a. PI will have a significant influence on PE, EE and PPI.
   b. H4b: Gender, age, experience and teacher training will define the influence of PI on CI, PE, EE, and PPI.

Management support

Management support (MS) is defined as the positive attitude of top management towards the use of technology and their support for the idea of employees using it in everyday tasks (Dwivedi et al., 2017; Sabherwal et al., 2006; Šumak et al., 2017). In this research, MS is considered to be the teachers beliefs about how the top school management and educational inspectors support the use of the DIK in education through encouraging teachers, providing the necessary equipment and ensuring the necessary expert help to enable teachers to use the DIK. On the basis of the above, we propose the following hypotheses:

1. H5: MS will have a significant influence on CI.
   a. H5a: Age, experience and teacher training will define the influence of MS on CI.

User interface quality

User interface quality (UIQ) is defined as the degree to which the teachers believe the designed interface allows them easy navigation and movement through the interface (Šumak et al., 2017). In this research, UIQ is considered to be the teachers' beliefs about the ease of navigating and moving through the DIK, as well as the organization and representation of the learning content in the user interface. We propose the following hypotheses:

1. H6: UIQ will have a significant influence on CI.
   a. H6a. UIQ will have a significant influence on EE.
   b. H6b: Gender and age will define the influence of UQ on CI and EE.

Technology compatibility

Technology compatibility (TC) is defined as the way in which the technology is compatible with existing software and hardware systems (Yang et al., 2016). In this research, TC is considered to be the teachers' beliefs about the compatibility of existing software which they use in education and the DIK. The following hypotheses are proposed:

1. H7: TC will have a significant influence on CI.
   a. H7a. TC will have a significant influence on UIQ.
   b. H7b: Age and experience will moderate the influence of TC on CI and on UIQ.

Social influence and student expectations

Social influence and student expectations (SSE) is defined as the extent of the degree to which individuals perceive as important the beliefs of and opinions of others that they should use a particular form of technology (Venkatesh et al., 2003). In the context of our research SSE can be attributed to groups such as students, colleagues, parents, and others, which might have different expectations of technology use. In this research, social influence is considered to be the beliefs of the teachers about whether their students and the

Table 1. Demographic characteristics of the sample of Montenegrin teachers who used the DIK for trees in teaching (n=232)

Variables	Frequency	%
Gender		
Female	194	83.6
Male	36	15.5
Missing	2	0.9
Age		
25-40 years	49	21.1
40-55 years	142	61.2
55-67 years	39	16.8
Missing	2	0.9
Career stage		
In the middle of the career	148	63.8
Senior years of the career	30	12.9
At the beginning of the career	52	22.4
Missing	2	0.9

parents of their students expect them to use the DIK. So, we propose the following hypotheses:

1. H8: SSE will have a significant influence on CI.
   a. H8a: Gender, age and experience will define the influence of SSE on CI.

RESEARCH METHODS

Variables in the Models

The unique dependent variable in this research is the CI which is actually considered as a teachers' intention to use the DIK in the future. The independent variables in this research were: PE, EE, PPI, PI, MS, UIQ, TC, and SSE. However, despite this, gender, age, experience and teaching training in using the DIK were also included as independent moderator variables (**Figure 1**).

Sampling and sample of research

According to the latest available data, the total number of teachers in Montenegrin primary schools is about 4,600 (Bulletin of the Ministry of Education of Montenegro, 2013). Around half of this number (about 2,100) teach students in the first and second cycles of primary school. That means our research population contains about 2,100 teachers. Purposive sampling was used in this research.

Due to the lack of a central email system, different strategies in recruiting respondents were applied. Primarily, the participants were recruited via school emails, which are publicly available on the internet, to which a request for help from the school head teachers was sent, asking them to inform their staff about the call. In the rare cases where a complete list of teachers was available, each teacher received an e-mail individually. The second channel was the social network pages of the Montenegrin Teachers' Society. The third channel was an open call posted on a number of teachers' social groups online.

Data collection lasted one month. After one month, overall, 468 teachers had started the online questionnaire, of which 326 partially or fully completed their responses. Among those who responded, 236 (72%) were users of the DIK application and 90 (29%) were non users. Because we were interested only in users of the DIK in this study we did not include in our analysis the data provided by non-users. We additionally excluded respondents with a large quantity of missing data. In the end we were left with 232 cases. Taking into consideration the total number of teacher in Montenegro which teach students in the first two cycles of primary school, it could be concluded that the data was supplied by about 11% of the total population. The demographic characteristics of the sample are presented in **Table 1**.

Questionnaire Development and Validation

The questionnaire was developed and stored in the open-source application 1KA (https://www.1ka.si/). In the questionnaire, the items were organized in the three categories: demographic characteristics, construct measurement items and additional question about the use of the DIK. CI was measured using three following items:

1. I will definitely use the DIK system on a regular basis in the next school year.;
2. Maybe I'll use the DIK on a regular basis in the next school year;
3. My intentions are to continue working with the DIK on a regular basis in the next school year.

Four items were used to measure EE, TC, PI, SE, MS and UIQ. Five items were used to measure PE and PPI. The measured items are presented in the results together with the descriptive statistics. A 7-point Likert scale with choices between defined extremes from "strongly disagree" (1) to "strongly agree" (7) was used. Besides the question on constructs, the questionnaire contained an open question where teachers were invited to propose a suggestion on how to increase the quality of the DIK. The answers to this open question can support quantitative analysis and it gave the respondents a chance to provide their personal opinions which were perhaps not captured in the closed questionnaire (Bryman, 2006; Hone & Said, 2016; Šumak et al., 2017). The participants were asked: Do you have any suggestions on how to improve quality of using the DKK in teaching?

The questionnaire was developed in English, and after that translated into Serbian-Montenegrin. The items were simultaneously checked by people who are proficient in both languages. This style of the creation of questionnaires for measuring the usage of technologies in education is recommended by both Chroustová et al.,

Table 2. Results of principal component analysis of the constructs

Construct	KMO & Bartlett's test	Eigenvalue	% of variance	Cronbach's alpha
SSE (SSE1, SSE2, SSE3, SSE4)	KMO=0.83 Bar=522.05 df=6 p<0.001	3.04	75.90	0.89
PPI (PPI1, PPI2, PPI3, PPI4, PPI5)	KMO=0.825 Bar=413.301 df=10 p<0.001	2.99	59.90	0.82
PE (PE1, PE2, PE3, PE4, PE5)	KMO=0.824 Bar=883.771 df=10 p<0.001	3.70	73.90	0.91 (0.92 if PE1 deleted)
UIQ (UIQ1, UIQ2, UIQ3, UIQ4)	KMO=0.802 Bar=357.489 df=6 p<0.001	2.71	67.75	0.84
PI (PI1, PI2, PI3, PI4)	KMO=0.790 Bar=497.825 df=6 p<0.001	2.84	71.15	0.862 (0.900 if PI 2 is deleted)
TC (TC1, TC2, TC3, TC4)	KMO=0.787 Bar=418.673 df=6 p<0.001	2.76	69.100	0.844 (0.851 if TC1 is deleted)
MS (MS1, MS2, MS3, MS4)	KMO=0.771 Bar=471.432 df=6 p<0.001	2.80	69.99	0.855 (0.883 if MS2 deleted)
CI (CI1, CI2, CI3)	KMO=0.755 Bar=719.352 df=3 p<.0001	2.74	91.17	0.95
EE (EE1, EE2, EE3)	KMO=0.732 Bar=337.285 df=3 p<0.001	2.38	79.27	0.87

(2017) and Šumak and Šorgo (2016). With the aim of ensuring the accuracy of the translations, the questionnaire was checked by three experts in the field of biological education. The questionnaire was pretested by 20 teachers, in order to ensure clarity. Following the suggestions of the pretest group, some questions were rewritten and clarified. The link to the final version of the survey was sent to the email addresses of 428 teachers, 84 schools and three teachers society and posted in seven teachers groups on various social networks.

Principal component analysis was used for the identification of construct uni-dimensionality (**Table 2**). In order to ensure that the data are suitable for factorial analysis the Kaiser-Meyer-Olkin (KMO) tests and Bartlett's test of sphericity were performed to summarize the analysis of all the constructs (**Table 2**). Internal consistency and Cronbach's alpha were used for the indication of the reliability score. All the reliability scores exceeded 0.80 (**Table 2**) which is the threshold for highly reliable constructs (Cohen et al., 2005).

Data processing

The data obtained in the questionnaire was processed using the IBM SPSS 24 statistical package. Taking into consideration that some of the variables do not have a normal distribution (showing a Kolmogorov Smirnoff test value of $p<0.05$) non- parametric tests were used. The Mann-Whitney U test was considered the most suitable for the determination of the significant difference between participants' opinions. Spearman's rank correlation test was applied with margins as follows; 0.31-0.50–slightly correlated; 0.51-0.70–moderately correlated; 0.71-0.90–highly correlated, on sums of the responses to each construct. In such a way, someone who completely disagrees with all the responses forming a construct can get nx1 points, and someone who completely agrees can get nx7 points (n=number of items in a construct). Principal component analysis with a previous check of the KMO and Bartlett's Tests was applied to check the uni-dimensionality of the constructs.

Table 3. Descriptive statistics (mean, median, mode, and standard deviation) and component loadings (PC) for indicators (n=232) for the CI construct

CI	Continuance intention	Miss	Mean	Med	Mode	SD	PC1
CI1	I'll definitely use DIK system on a regular basis in next school year.	1	5.81	6.00	7	1.08	0.96
CI2	My intentions are to continue working with DIK on a regular basis in next school year.	1	5.67	6.00	5	1.05	0.94
CI3	Maybe I'll use DIK on a regular basis in the next school year.	1	5.74	6.00	5	1.03	0.97
sumCI		1	17.2	18.0	21.0	3.03	

Table 4. Correlations between constructs

Constructs	sumCI	sumPE	sumEE	sumPPI	sumUIQ	sumTC	sumPI	sumSSE	sumMS
sumCI	1.00								
sumPE	0.57^{**m}	1.00							
sumEE	0.67^{**m}	0.66^{**m}	1.00						
sumPPI	0.71^{**h}	0.63^{**m}	0.71^{**h}	1.00					
sumUIQ	0.71^{**h}	0.59^{**m}	0.59^{**m}	0.73^{**h}	1.00				
sumTC	0.53^{**m}	0.49^{**l}	0.36^{**l}	0.49^{**l}	0.44^{**l}	1.00			
sumPI	0.38^{**l}	0.37^{**l}	0.28^{**s}	0.40^{**l}	0.36^{**l}	0.64^{**m}	1.00		
sumSSE	0.35^{**l}	0.30^{**l}	0.24^{**s}	0.32^{**l}	0.41^{**l}	0.39^{**l}	0.47^{**l}	1.00	
sumMS	0.33^{**l}	0.23^{**s}	0.19^{**s}	0.19^{**s}	0.22^{**s}	0.26^{**s}	0.22^{**s}	$0.59m^{**}$	1.00

Note. Correlation ranges: s: 0.20-0.30–slightly correlated variables; l: 0.31-0.50–low correlated; m: 0.51-0.70– moderately correlated; h: 0.71-0.90– highly correlated

The participants' answers to open-ended questions were processed with the application of grounded theory and open manual coding was used (Strauss & Corbin, 1990). The researchers independently coded the material and developed themes based on it. The reliability of the obtained codes as well as the themes were checked against the degree of agreement in the basic codes and their allocation into the themes among the researchers. Cohen's kappa coefficients were tallied as a measure of inter-rater reliability between the coders. Cohen's kappa coefficients were discovered to be .83. The agreements above .80 are considered almost perfect agreements (McHugh, 2012).

RESULTS

Descriptive statistics, the median, mode and standard deviation and principle component analysis, as well as missing data and correlations between constructs are provided. Comments of the results are also provided.

Continuance Intention

CI is regarded as the outcome construct in our model. It is assembled from three statements. We can identify from **Table 3** that definitely using the DIK on a regular basis in the next school year receive the highest response rate, however, the difference between the items is quite small (r=0.905). The distribution of sums is heavily skewed toward the completely agree response tail. The mean lies only at 3.8 points (18.09%) from a maximum of 21. The correlations of CI with other constructs are presented in **Table 4** and **Figure 2**.

Influence of constructs on CI

The influence of the constructs on CI can be revealed by an inspection of the correlations in **Table 4**, graphically presented in **Figure 2**. Two constructs, UIQ and PPI, have the highest influence on teacher's CI. The following three constructs PE, EE, and TC have a moderate influence on CI. As such, hypotheses H3 PPI will have a significant influence on CI (Ertmer, 2005; Šumak & Šorgo, 2016) and H6 UIQ will have a significant influence on CI have been confirmed at the highest level. Hypothesis H1 PE will have a significant influence on CI (Venkatesh et al., 2003), Hypothesis H2 EE will have a significant influence on CI (Venkatesh et al., 2003), and hypothesis H7 TC will have a significant influence on CI (Yang et al., 2016) are confirmed at a moderate level. Differences between teachers of different gender, age, experience and teacher training were not found ($p<0.001$). These results are in line with the results of other similar research. So, for example, Chiu et al. (2005) underline that PIQ significantly influences the CI of the learners about using e-learning. We were not able to find research that examines the influence of teachers' PPI on the CI of using certain technologies in teaching. However, similar research which explores the teachers' BI confirms the high influence of the PPI on teacher intention about using technology in teaching (Chroustová et al., 2017; Šumak et al., 2017).

We can recognize from **Figure 2** and **Table 4** that all the correlations between the constructs expected to influence CI are statistically significant at the $p<0.001$ levels. However, we can also see that most of the correlations fall into the weak to moderate ranges (0.23-0.70). The highest values are close to the lower border of

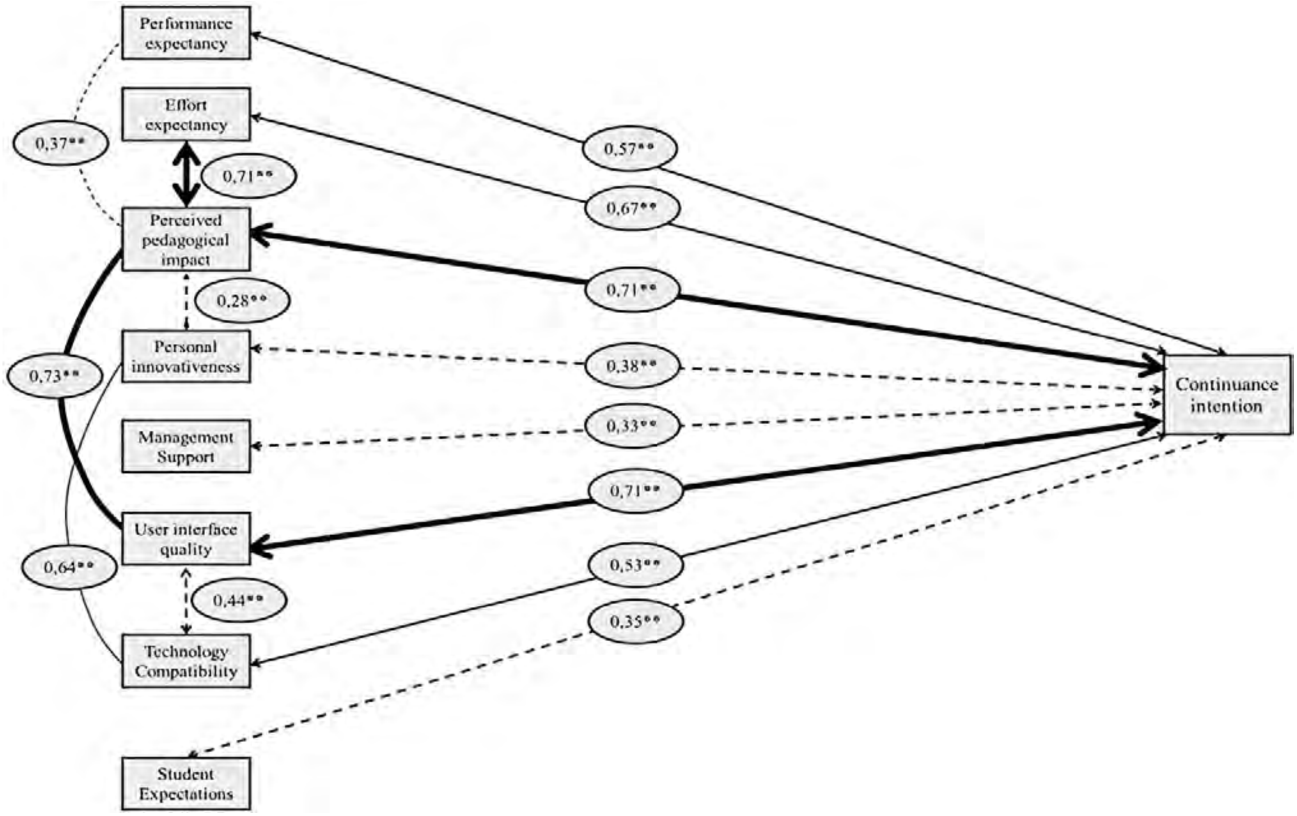

Figure 2. The model of the relationship between variables (-high relation; -moderate relation; - -low moderation)

Table 5. Descriptive statistics (mean, median, mode, and standard deviation) and component loadings (PC) for indicators (n=232) for the PE construct

PE	Performance expectancy	Miss	Mean	Med	Mode	SD	PC1
PE1	I find the DIK useful in teaching.	1	6.07	6.00	7	0.98	0.71
PE2	Using the DIK increase my productivity while teaching.	1	5.52	5.00	5	1.07	0.89
PE3	Using the DIK increase the effectiveness of my teaching.	1	5.31	5.00	5	1.14	0.92
PE4	Using the DIK make it easier to do the teaching	2	5.03	5.00	4	1.30	0.88
sumPE		3	26.6	25.0	35.0	5.10	

Table 6. Descriptive statistics (mean, median, mode, and standard deviation) and component loadings (PC) for indicators (n=232) for the EE construct

EE	Effort expectancy	Miss	Mean	Med	Mode	SD	PC1
EE1	The DIK is easy to use.	1	6.11	6.00	7	0.87	0.88
EE2	Acquiring the skills to implement the DIK in teaching is simple.	3	6.14	6.00	7	0.95	0.91
EE3	My interaction with the DIK is clear and understandable.	1	6.12	6.00	7	0.87	0.88
SumEE		3	18.3	18	21	2.4	

high correlation. We comment on them under the constructs.

Performance Expectancy

We can identify from **Table 3** that the usefulness of the DIK receives the highest response rate; however, this is not because it allows the teachers to achieve their teaching task quicker (PE5). Hypothesis H1 that PE will have a significant influence on CI (Chiu & Wang, 2008) is proved (**Table 5** and **Figure 2**). However, the influence was only moderate. We were not able to find differences between teachers of different gender, age, experience or teacher training at a significance level of $p<0.001$. It is clear that PE moderately correlates with EE, PPI, UIQ, and TC.

Effort Expectancy

As the results presented in **Table 6** indicate, the highest response rate in the construct EE was shown by the item which considered the ease of getting skills for using the DIK in teaching. Nonetheless, the difference between the items in this construct is minimal. The hypothesis (H2) that EE will have a significant influence on CI (Panigrahi et al., 2018), has been confirmed at a moderate level (see **Figure 2**). The results indicate a significant relationship between EE and PPI and a

Table 7. Descriptive statistics (mean, median, mode, and standard deviation) and component loadings (PC) for indicators (n=232) for the PPI construct

PPI	Perceived pedagogical impact	Miss	Mean	Med	Mode	SD	PC1
PPI1	Using the DIK in teaching has an impact on students' active engagement in the teaching process.	1	6.32	7	7	0.82	0.83
PPI2	The DIK has an impact on students' motivation.	1	6.36	7	7	0.82	0.81
PPI3	Using DIK in teaching has an impact on academic achievement.	1	5.90	6	7	1.14	0.73
PPI4	Using DIK in teaching has impact on students' attitudes to plants.	1	6.68	7	7	0.70	0.74
PPI5	Using the DIK in teaching has an impact on the time which students spend exploring the world around them.	1	5.86	6	5	0.94	0.75
sumPPI		1	31.1	32	35	3.4	

Table 8. Descriptive statistics (mean, median, mode, and standard deviation) and component loadings (PC) for indicators (n=232) for the PI construct

PI	Personal innovativeness	Miss	Mean	Med	Mode	SD	PC1
PI1	I like to experiment with new technology.	1	5.10	5	5	1.15	0.91
PI2	I like to experiment with new teaching materials.	3	5.93	6	6	0.98	0.66
PI3	In general, I don't hesitate to try out new information technologies in teaching.	4	5.28	5	5	1.14	0.90
PI4	If I heard about a new form of information technology, I would look for ways to experiment with it.	2	4.90	5.00	5	1.34	0.88
sumPI		5	21.1	21	28	3.8	

moderate correlation between PE and UIQ. Differences between teachers of different gender, age, experiences or teacher training were not founded (p<0.001).

Perceived Pedagogical Impact

Table 7 illustrates that the influence of the DIK on student attitudes toward the plants received the highest response rate. On the other hand, the influence of the DIK on the time which students spend exploring nature received the lowest response rate. Hypothesis H3 that PPI will have a significant influence on CI (Ertmer, 2005; Šumak & Šorgo, 2016) has been confirmed at a level matching the lower border of high correlation (**Figure 2**). In this research, differences in the correlation of the construct based on the influence of gender, age, experience or teacher training have not been found (p<0.001). Hypothesis H3b that PPI will have a significant influence on PE has been confirmed at a moderate level. As is mentioned above, a significant correlation was registered between PPI and EE. However the most significant correlation in the whole model is that between PPI and UIQ.

Personal Innovativeness

It can be seen from the data in **Table 8** that in the PI construct, the highest response rate was shown for teachers likeliness to experiment with new teaching materials, but this was not because teachers like to experiment with new information technology. Hypothesis H4 that PI will have a significant influence on CI (Lu, 2014; Mahat et al., 2012) has been confirmed only at a low level (Figure 2). At the same level, we confirmed Hypotheses H5b that PI will have a significant influence on PE, EE and PPI. In this research, we found no differences in terms of gender, age or teacher training (p<0.001). It was revealed that PE moderately correlates with TC.

Management Support

In terms of the construct MS, the highest response rate was received by the recognition of using the DIK on the part of educational inspectors. Showing the opposite score, we find the claim that the school's management is aware of the benefits of using the DIK in teaching (**Table 9**). Hypothesis (H5) that MS will have a significant influence on CI (Hart & Henriques, 2006) has been confirmed at a low level (**Figure 2**). MS moderately correlates with SE. However, in this research differences between gender, age, and teacher training were not found (p<0.001).

User Interface Quality

As can be seen from **Table 10**, the ease of navigating through the DIK received the highest response rate, which is in contrast to the attractive presentation of the teaching content in the DIK. Hypotheses (H6) that UIQ will have a significant influence on CI (Joo et al., 2014; Ong et al., 2004; Shin et al., 2011; Smet et al., 2012) has been confirmed at the lower border of the level of high correlation (**Figure 2**). In this research, we did not find any differences in terms of teachers of different gender, ages, experiences, or teacher training at the level of p<0.001. Hypothesis H6b that UIQ will have a significant influence on EE has been confirmed at a moderate level. Apart from this, UIQ has a significant correlation with PPI and a moderate correlation with PE.

Table 9. Descriptive statistics (mean, median, mode, and standard deviation) and component loadings (PC) for indicators (n=232) for the MS construct

MS	Management support	Miss	Mean	Med	Mode	SD	PC1
MS1	The director of the school encourages me to use the DIK for instruction.	1	3.68	4	3	1.51	0.87
MS2	The educational inspector recognizes my efforts in using the DIK for instruction.	1	4.61	5	5	1.41	0.67
MS3	Schools management provides most of the necessary help and resources to enable people to use the DIK.	2	3.44	4	4	1.64	0.87
MS4	Schools management is aware of the benefits that can be achieved by the use of the DIK in teaching.	1	3.43	3	4	1.54	0.89
sumMS		2	15.2	15	16	5	

Table 10. Descriptive statistics (mean, median, mode, and standard deviation) and component loadings (PC) for indicators (n=232) for the UIQ construct

UIQ	User interface quality	Miss	Mean	Med	Mode	SD	PC1
UIQ1	It is easy to navigate through the DIK.	2	6.15	6	6	0.83	0.77
UIQ2	The user interface of the DIK is interactive and well organized.	1	5.71	6	5	1.	0.84
UIQ3	The teaching content in the DIK is presented in an attractive way.	4	5.39	5	5	1.10	0.85
UIQ4	The implementation of the DIK in teaching creates an audio-visual experience.	1	5.64	6	5	1.05	0.83
sumUIQ		5	22.8	23	28	3.98	

Table 11. Descriptive statistics (mean, median, mode, and standard deviation) and component loadings (PC) for indicators (n=232) for the TC construct

TC	Technology compatibility	Miss	Mean	Med	Mode	SD	PC1
TC1	The software for the DIK is compatible with other devices I use (laptops, tablets, PCs, smart phones and so on).	2	5.29	5.00	5	1.01	0.73
TC2	Using the DIK fits into my lifestyle.	1	4.82	5.00	5	1.16	0.84
TC3	Using the DIK is compatible with all aspects of my teaching.	1	5.25	5.00	5	0.91	0.89
TC4	Using the DIK is compatible with the instructions which I usually use in teaching.	2	5.30	5.00	5	0.97	0.87
sumTC		3	20.6	20.0	21.0	3.3	

Table 12. Descriptive statistics (mean, median, mode, and standard deviation) and component loadings (PC) for indicators (n=232) for the SSE construct

SSE	Social influence and student expectations	Miss	Mean	Med	Mode	SD	PC1
SSE1	Students expect me to use the DIK.	3	4.63	5.00	4	1.26	0.88
SSE2	Students' parents expect me to use the DIK.	2	3.87	4.00	4	1.66	0.87
SSE3	People who influence my behavior think that I should use the DIK.	2	5.01	5.00	5	1.24	0.86
SSE4	Colleagues in my organization who use the DIK have more prestige than those who do not.	1	4.53	5.00	4	1.31	0.87
sumSSE		5	18.0	18.0	20.0	4.7	

Technology Compatibility

In terms of the construct TC, the highest response rate was shown by the compatibility of the DIK with the instructions which teachers use in their teaching (see **Table 11**). However, the fit of the DIK into the teachers' lifestyle received the lowest response rate. Hypothesis (H7) that TC will have a significant influence on CI has been confirmed at a moderate level (see **Figure 2**). There was a significant positive correlation between TC and PI at a moderate level. The correlation between TC and PE and PPI is at the border between low and moderate. Hypothesis H7b that TC will have a significant influence on UIQ has been confirmed at a low level. Differences between teachers based on gender, age, experience and teacher training at the level of $p<0.001$ were not registered in our results.

Social Influence and Student Expectations

According to the data, from **Table 12** we can infer that the opinions of the people who influence teacher's behavior receive the highest responds rate, and not the expectation of students' parents. Hypothesis H8 that SSE will have a significant influence on CI has been confirmed only at a low level (see **Figure 2**). We were not able to find differences between teachers of different gender, age, experience or teacher training at the level of $p<0.001$. SSE had a moderate correlation with MS, while with all the other factors this correlation was at a low level.

Teacher suggestions about increasing quality of DIK

In an attempt to consider teacher opinions about the DIK as comprehensively as possible in the questionnaire, open questions were used. A total of 48 participants (20.68%) provided answers to the open-ended questions. The answers are classified into two themes. The first theme is the interface quality, the second is the interaction between the DIK and the student workbook. Sixteen teachers (33.33% of those making suggestions) suggest that adding the appearance of different sounds or different animations when the students determine a plant using the DIK could further attract the student's attention and increase their motivation to use the DIK in plant identification. Eleven teachers (22.92%) suggested adding a task in the DIK which would direct the students to work on a task in the workbook, believing that could be useful and increase the student's knowledge.

DISCUSSION

The goal of this study was to determine the factors which influence teachers', who had applied the DIK, in their continuing intention to use them in primary schools. Results of our research revealed that PPI and UIQ has the greatest influence on teachers' CIs. Our research mirrors the results of Chavoshi and Hamidi (2019) and Zhao and Cziko (2001). One interesting element of this data is that teachers believe that the DIK can influence the student's attitude toward plants, which potentially could be used for the prevention of *plant blindness*. This is one of the most striking results of our research, especially if we consider that the lack of student interest in learning about plants is one of the main causes of plant blindness (Amprazis & Papadopoulou, 2020, Pany, 2014; Remmele & Lindemann-Matthies, 2018). This suggests that the application of the DIK could contribute to the development of students' positive thinking about plants, which would reduce the incidence of plant blindness and ensure a better understanding of their importance to nature on the part of students. This assumption should be examined in future research. Another interesting finding in this research is teachers' opinions on the contribution of the DIK to students' knowledge about plants are consistent with previous research conducted by Anđić et al. (2020) and Stagg and Donkin (2016). The results of these studies indicate that the application of the DIK in biology teaching contributes more than the application of dichotomous printed keys to students' knowledge about plants at higher cognitive levels, which include not only species identification, but distinguishing systematic affiliation and the ability to independently create a dichotomous key for a smaller number of plant species from the student's own environment. The results of other previous research indicate that if students have the skills to identify species from their environment, they have a more positive attitude towards them, and will use them in a more sustainable way in accordance with the relevant SDG goals (Amprazis & Papadopoulou, 2020; Turner-Skoff & Cavender, 2019). Summarizing the results of this and previous research, it can be concluded that the opinions of teachers on the contribution of the DIK to the knowledge and attitudes of students about plants are in accordance with the previous research that has dealt with this topic. The influence of UIQ on the teachers decision to use some technology are confirmed in prior studies, for example, Ong et al. (2004) and Wu and Zhang (2014), in which it was concluded that UIQ influences EE and PE as well as CI. A strong relationship between DIK interface quality and its usability among the teachers, students, and amateur botanists has been reported in the literature (Anđić et al., 2021; Jacquemart et al., 2016; Stagg et al., 2015). Jacquemart et al. (2016) stressed that the user-friendly interface of DIK and its screen appearance on mobile devices such as tablets and mobile phones are the main factors which determine its acceptance in teaching botanical content in schools. Anđić et al. (2021) pointed out that DIK interface quality influences the level of knowledge that primary school students gain by using that DIK in plant identification. Silva et al. (2011) and Stagg et al. (2015) concluded that a well-developed DIK interface provides a learning tool that teachers could use to provide a multimedia learning experience to their students which leads to their greater motivation to learn about a higher level of botanical knowledge. It can thus be suggested that the development of DIKs interface quality in one of the main factors which influence teachers' continuance decision, alongside successful usability in terms of student experience.

Performance expectations, effort expectations and technical compatibility have a moderate on teachers' CI of using DIK. Our results are similar to those of Wu and Zhang (2014) who indicate that PE influenced CI towards E-Learning, and also identify the correlation between PE, EE, and UIQ. However, in the results described by Mensah (2019), there was no correlation between PE and CI. The results of our research are supported by the results of previous research conducted by Torkar (2021), which indicate that the usefulness of the DIK is one of the main factors influencing the decision of teachers to use the DIK as a teaching tool in teaching. Bajd et al. (2012) points out that teachers use the DIK more in teaching insofar as these teaching aids are purposely created for the geographical region, or country, in which they teach, because this increases the efficiency of the DIK in teaching and its usefulness. Summarizing our results and the results of the above-mentioned research, it can be concluded that a purposefully created DIK for a particular area or country will contribute to greater applicability of the SEC in teaching and contribute to the intention of teachers to use them in teaching. This could be of particular interest to creators of DIKs, teaching publishing houses, and policy creators who would like to develop DIKs for teaching purposes, or other similar materials. Similar results about the moderate influence of EE on CI were obtained in the research by Chiu and Wang (2008) and Shin et al. (2011). However, the values are distinguishable from the results provided by Zhou (2011), who did not find a correlation between EE and CI. To the best of our knowledge, in other similar research, a correlation between EE and PPI was not found. However, previous research (Anđić et al., 2018), examining the contribution of dichotomous keys to the biological knowledge of students indicates that the DIK makes a greater contribution to students' knowledge than the same dichotomous keys in a printed version, due to easier interaction with it and the ease of use of the software. Bayne et al. (1998) indicate that mastering the skills and abilities that enable the use of biological keys is one of the most important goals of biology teaching, which is why their careful development and implementation in teaching is so necessary. As can be seen, the ease of use and clear interaction between teachers and students with the DIK, as a part of EE, influenced the usability of DIK in teaching and learning, as well as the knowledge that students acquire while using the DIK. This indicates that software design and software concepts are of great importance for the usability and use of SEC in biology teaching. Our results about moderate influence CI by TC of are in agreement with those obtained by Ifinedo (2018) and Liao and Lu (2008).

Our results show that MS, PI and students' expectations have a low influence on teachers' CI of using DIK. These results are in line with other research which concluded that MS is important in accepting and using technology (Gagne et al., 2000). Previous research by Jose et al. (2019), Thomas et al. (2021), and Uno (2009) indicates that in the prevention of plant blindness in students, cooperation between teachers, botanists, educational policymakers, and school management is very important. The results of our research indicate that teachers' decisions in relation to CI for using DIKs is most obviously influenced by the recognition of their efforts in using these teaching tools on the part of educational inspectors. These results may be of particular importance to education policymakers in developing strategies to introduce DIKs and similar educational technologies in schools. In our research SSE and PI, had a low influence on teachers' CI. Similar results have been obtained in other research which considered a social influence on CI, notably Chiu and Wang (2008), Lai and Chen (2010), and Wu and Zhang (2014). These results are consistent with the data obtained in the research by Joo et al. (2014) and Liu et al. (2010), in which PI is one of the predictors of CI. However, the results given in Lu (2014), indicate that PI strongly influences CI, whereas our results match this only at a low level.

The results of our study reveal that teachers believe that adding animations and sound to the software used by DIK would improve their effectiveness in teaching. This opinion of teachers is reflected in the results of the research conducted with students by Odadžić (2016). The results of that research indicate that educational software enriched with sound and animations contributes more to motivating students to acquire knowledge with its help than when these elements are not an integral part of educational software. Županec et al. (2014) pointed out that educational software in biology teaching should provide students with a multisensory experience through the inclusion of animation or video, sound, quality photography, and the like. The results of our research, as well as the above-mentioned previous research, could be very useful for developers of educational biological software as well as the publishing houses that publish these materials. Even if the DIK itself does not require the inclusion of sound and animation, according to the opinion of the participants in our research, but also the opinion of students in previous research (Anđić et al., 2020), the inclusion of these elements into the software would contribute to the greater usability of the DIK in primary school education. Another very interesting fact that our research points to is that according to the opinion of teachers, connecting textbooks and DIK increased their effectiveness in teaching. Kirschner et al. (2012) and Županec et al. (2014) point to the great importance of linking educational software to additional materials such as students' textbooks and workbooks. In these studies, it is stated that this connection facilitates easier access to the software, increases students' motivation to learn, and contributes to the better knowledge of students who use these materials to acquire knowledge. The opinion expressed by the teachers who participated in our study that the connection of the DIK with the student's tasks in the workbook would result in better knowledge of students about plants might serve as a hypothesis for future research in this area.

Limitations

We are aware that our research may have various limitations. The first is the possibility that the results reflect the views only of those who were willing to answer our questions about user opinions and experience with the DIK in education. As such these results have limited generalizability for the non-users or prospective users. The second limitation is that our research was conducted in Montenegro which is a developing country. In Montenegro, the development of education technologies, applications, and their implementation in teaching is growing but is still in its early stages. Thus, our results have limited generalizability for users in other countries, especially in developed countries. The third limitation is the data in this research is cross-sectional. Our construct measured single-point opinions, contrary to using the dichotomous key in education which is an ongoing process.

CONCLUSIONS AND PRACTITIONER NOTES

In this research, we have described the factors which affect teachers' decisions about CI in using the DIK in biology teaching in primary schools. In the research, we included the existing users of the DIK. The measurement instruments for the identification of the factors that influence teachers' decisions in terms of CI in using the DIK were created on the basis of the UTAUT model and continuance theory in combination with the ECM. The evidence from this study suggests that the PPI and UIQ have the most significant influence on CI among teachers regarding using the DIK in the future. Performance expectations, effort expectations, and technical compatibility has a moderate influence on teachers' CI about using the DIK. The weakest impact on the teacher CI about using the DIK was provided by PI, MS, and student expectations. On the basis of the results of this research, it might be concluded that the proposed methodology is feasible for evaluating the factors which affect teacher's decisions about CI regarding the DIK in primary schools. Our study provides the first research model for teachers' CI of using the DIK in primary schools, which is important for the improvement of biology teaching. Future research should extend or improve the research model offered here.

This research provides educational institutions and educational practitioners with the first research model which could be used in the evaluation of CI in using the DIK in the biological education of students in primary schools. The results of this research suggest a practical direction for designers of digital dichotomous keys, in that special attention should be placed on UIQ in the creation of the DIK, as well as on the pedagogical influence that the DIK can have. It is interesting that teachers believe that using a DIK in education influences students' opinions about plants, and this suggestion could be used for the prevention of *plant blindness* in the future.

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