Self-Assessment of Pre-service English Teachers' Digital Competence

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Abstract – **Digital competence is considered an integral component of the skills and professional expertise of teachers nowadays. The aim of this study was to explore the perceptions of 82 pre-service English language bachelor and master level teachers from a state university in Bulgaria on their digital competence based on the interplay of five variables – competence for using and integrating ICT in the foreign language classroom, technological pedagogical knowledge, support received during training, capacity to promote the digital skills of their learners and attitude towards integrating digital technologies in their future professional practice. Based on the performed descriptive, correlational and inferential analysis of the data obtained, it was established that the most strongly related variables were the self-perceived competence of the pre-service teachers for using and integrating digital technologies in the teaching and learning of foreign languages and their capacity to promote the digital skills of their learners.**

Keywords – *digital competence; pre-service teacher training; assessment.*

I. INTRODUCTION

Digital technologies constitute an essential part of the 21st century classrooms and require specific knowledge, competences and skills from teachers (and subsequently from learners) in order to function successfully in an interactive, dynamic and ICT-based educational context. Teachers nowadays are expected to be not only technically competent in managing the rich spectrum of devices, tools and applications to communicate with students and colleagues, to collaborate professionally, to create and share content, but also possess an ability to critically approach technology from a pedagogical perspective.

Given this, teachers' digital literacy has become a topic of interest in a vast number of theoretical frameworks which approach the concept from different perspectives. While some authors stress the fact that it entails elements from many domains (e.g. literacy, cultural studies, communication, technology studies) [1], others directly state that it is a "pluralist concept" [2] due to its multidimensional nature [3]. Despite the variety of interpretations, most researchers agree that educators' digital competence is an umbrella term which entails the knowledge, skills and abilities of teachers to implement effectively digital technologies in their teaching practices and in supporting their students' active learning. Training future teachers to deploy productively and creatively digital tools into education is thus a key priority on the European agenda and a target in the educational policies of many countries.

Bulgaria is not an exception in this case. In 2019 the Government introduced the "Digital Bulgaria 2025 National Programme" [4] which promotes the strategic development of digital competence of all citizens aiming to increase their competitiveness and strengthen their employability. Central to the envisaged reforms is the enrichment of teachers' pedagogical repertoire with new formats and methods for digital engagement of learners. In line with this, the Ministry of Education and Science designed the "Digital Qualification" National Programme [5] in 2021 and has already started upskilling school teachers and university academic staff for using ICT, digital content and online teaching tools in their classes. These steps, however, are a follow-up of the profound changes made in the state regulated requirements concerning the training of pre-service teachers. According to these regulations introduced in 2018, all pre-service teacher training programmes offered by higher educational institutions on a national level should include the following two courses "Information and Communication Technologies and Work in Digital Environment" (as a compulsory component) and "Digital Competence and Digital Creativity" (as an elective component) each comprising of at least 30 academic hours. Apart from these two officially required courses, universities have the freedom to enrich their educational offer with study courses designed to upgrade pre-service teachers' digital competence. In fact, higher educational institutions are supposed to do so since the digital capacity of teacher trainees to integrate ICT-based technologies in an innovative and sustainable way in their teaching and in the learning experiences of their pupils are among the core outcomes of the pedagogical training offered at university level.

Since these courses are part of the training of pedagogical specialists in the last 3 years, it is expected that each higher educational institution in the country has not only offered a blend of courses fostering the digital competence of student teachers, but has also assessed their relevance, usefulness and efficiency. Contrary to the expectations, data on the quality of this training on the digital competence of teacher trainees in Bulgaria is limited. This study, therefore, is an attempt to address the existing gap in research literature by providing insights into the digital competence of pre-service teachers in the University of Ruse based on their self-assessment. It

examines the perceptions of pre-service teachers about their skills to employ digital technologies in the teaching of English as a foreign language (L2) and in empowering learners to use digital tools and resources for self- or collaborative L2 learning and assessment. The objective of the provided analysis is to determine also the attitude of future English language teachers towards the integration of ICT-based educational technologies in their L2 classrooms.

II. LITERATURE REVIEW

The advancements in digital infrastructure in all spheres of our daily lives along with the availability and vast use of digital devices have shaped the ways in which the generations born and raised in a digitally saturated world, i.e. the so called "digital natives" [6], communicate, learn and socialize. Feeling comfortable with technologies from an early age, young people nowadays are good at multitasking, have advanced technical skills, rely heavily on technology when they need or want to share information and learn best when actively engaged. These characteristics of the digital natives pose new requirements on the training of pre-service teachers, who although being digital natives themselves, need formal instruction for integrating digital technologies in a pedagogically sound manner in their classrooms. That applies in particular to the future L2 teachers since digitization has reshaped the teaching and learning of foreign languages by enriching them with technology-based applications and tools that foster meaningful communication and language skills refinement, on the one hand, and which trigger learners' autonomy, collaboration and creativity, on the other hand.

The integration of digital technologies in the training of teachers at university level requires from higher educational institutions to embrace new paradigms for knowledge co-creation through digital inclusion. To achieve this, universities are guided by the methodological and assessment frameworks which define the knowledge, skills and competences which future educators need to possess in order to create, manage and support digital learning experiences.

One of these frameworks is the European Framework for the Digital Competence of Educators (DigCompEdu) [7]. It specifies 22 digital competences distributed among six areas of expertise which cover teachers' professional and pedagogical abilities to utilize digital applications and tools in education, on the one hand, and their skills to facilitate learners' digital literacy, on the other hand. Another framework, which also organizes the competences of teachers in six main thematic areas, is the DC4LT Assessment Framework [8]. Although it is targeted at foreign language teachers, its categories correspond to a significant extent to the areas of teachers' digital expertise in DigCompEdu (Table I).

The thematic areas of these two frameworks and the digital competences identified in them suggest that teachers' skills to engage with digital technologies in a competent, critical and creative way are an essential prerequisite for incorporating ICT-based technologies in

the classroom, but only technological knowledge and skills are not enough for efficient teaching and learning.

TABLE I.   THEMATIC AREAS OF DIGCOMPEDU AND DC4LT

Digital competence assessment frameworks	
DigCompEdu	*DC4LT*
Pedagogical engagement	Professional development
Digital Resources	Technology
Teaching and learning	Pedagogy
	Content
Assessment	Assessment
Empowering learners	Learner's support
Facilitating learners' digital competence	

Recent research studies [9, 10] demonstrate that pre-service teachers need to be equipped with knowledge and competences to approach technology as a pedagogical tool. In this respect, the TPACK model proposed by Mishra and Koehler [11] puts forward the idea that technology, pedagogy and content are in constant interplay so digital teaching involves a more complex type of knowledge – technological pedagogical content knowledge. This type of knowledge allows teachers to gain understanding of how specific subject-related content can be represented and taught through technology, how a diverse scope of pedagogical approaches, strategies and techniques can be used to engage students with the subject matter and with each other in digitally mediated forms of instruction and how students' previous knowledge and skills (incl. digital literacy) can be used to boost learners' performance and development.

It has been established that prospective teachers' attitudes have a profound influence on their willingness to use digital tools and applications [12] and are a predictor for both the integration of TPACK and technology in the education process [13]. These findings correlate with the theoretical underpinnings of the Technology Acceptance Model (TAM) [14] and its extensions which postulate that the adoption of new technology depends on the attitude of the user to that technology, which in turn, depends on two factors: perceived usefulness of the technology and perceived ease of use. Technology acceptance, however, is not only linked to ICT attitudes. Rather, it is a follow-up of rigorous training which concentrates on the pedagogical aspects of embedding digital technologies in the teaching and learning process. Such an assumption is also shared by [15] who designed the Synthesis of Qualitative Data (SDQ) model for training pre-service teachers to implement technology. It comprises three levels which have a direct reference to the development of pre-service teachers' skills for technology integration and offers six strategies on the micro level: Role models, Collaboration, Instructional design, Authentic experiences, Reflection, and Feedback. When operationalized, these six strategies enhance the intersection of content, pedagogy and technology in the training of pre-service educators (Table II).

In addition to the SQD model, teacher candidates' self-efficacy with digital tools and applications is considered an indicator for their aptitude to create and manage a technology-driven educational process. Empirical data confirm that trainee teachers who conduct classes in

which they frequently integrate digital technologies, have higher self-efficacy [16]. Similarly, [17] and [18] acknowledge that pre-service training programmes that provide digital training courses boost candidate teachers' abilities and readiness to include ICT-based tools and resources in their classrooms, thus increasing their technological self-efficacy. Consequently, the assessment of future teachers' technology self-efficacy can provide valuable data on the effectiveness of such a programme.

TABLE II.　Micro level strategies of the SDQ model

Micro level strategy	Manifestation in the pre-service teacher training
Role model	Teacher trainees observe their tutors or school teachers use technology in a meaningful way in the classroom
Reflection	Pre-service teachers reflect upon and discuss with their mentors about the use of technology in the teaching and learning process
Instructional design	Pre-service teachers get help in designing lessons that include digital technologies
Collaboration	Teacher candidates share experience, work together and support each other in their technology learning endeavours
Authentic experiences	Teacher trainees check their digital competences in real classrooms (e.g. during teaching practice, internships, etc.)

Adapted from [15]

Almost all related literature works suggest that new studies on pre-service teachers' digital competence need to be conducted in order to extend the bulk of research with new perspectives and relevant findings on the effect of factors such as attitudes towards technology on the digital capacities of beginning teachers.

III. METHODOLOGY

A. Study sample

The participants in the study were 82 pre-service teachers from the University of Ruse (Bulgaria) out of which 62 (75.6 %) enrolled in the bachelor level programme preparing teachers of English to young learners and 20 (24.39 %) enrolled in the two master level programmes, respectively for training future teachers of English to young learners and for preparing teachers of English to lower secondary school learners. The mean age was 24.85 (SD = 5.114) and the gender ratio was typical for the educational strand of programmes at the university – 92.68 % (N = 76) female and 7.32 % (N = 6) male students. The participants were in their second (66.13 %; N = 41), third (32.26 %; N = 20) and fourth year (33.87 %; N = 21) of training.

B. The instrument

A self-evaluation questionnaire specifically designed for the purposes of the study was used. It comprised six sections and was written in Bulgarian. The first section collected demographic data (age, gender, year and level of study). The other sections assessed the responses of the study sample on each of the items in the variables along a 5 point Likert scale ranging from 1 (Strongly disagree) to 5 (Strongly agree).

The Self-perceived pre-service teachers' competence for integrating ICT in L2 instruction (SP CUT) was measured in the second section with 8 items focused on assessing the ability of the study participants to use technology in L2 teaching and learning and 6 items assessing their skills to organize and manage digital assessment. Each of these items is developed on the basis of descriptors from two of the assessment frameworks – DigCompEdu and DC4LT. From DigCompEdu we have utilized and adapted competences from Area 2: Digital resources and Area 4: Assessment, while from the second framework – descriptors from the thematic categories "Technology" and "Assessment". The Cronbach's alpha value of the 14 items was 0.843.

The Self-perceived technological pedagogical knowledge (SP TPK) of the study sample was measured with 5 items resulting from the adaptation of descriptors from the thematic categories "Pedagogy" and "Content" of DC4LT and the domains of the TPACK model [17]. The Cronbach's alpha of these 5 items was 0.702.

The Self-perceived support received during training (SP SRD) of the pre-service study participants was measured by 6 items reflecting each of the strategies in [15]. The Cronbach's alpha of these 6 items was 0.780.

The Self-perceived capacity to promote the digital skills of L2 learners (SP CDL) of the future English language teachers was assessed by 6 items designed following the descriptors of the DigEduComp in Area 6: Facilitating learners' digital competence and the DC4LT thematic category "Learner support". The Cronbach's alpha of these 6 items was 0.786.

The last section – Self-perceived attitude towards the use of digital technology in L2 instruction (SP ATU) contained 4 items providing data on the individual beliefs of the study subjects towards ICT and their intention towards incorporating it in English language teaching contexts. The Cronbach's alpha of these 4 items was 0.831.

C. Research questions

Two main questions were considered in the research study:

1. What is the interplay among the five variables constructing the digital competence of the pre-service bachelor and master level teachers?

2. Which of the variables constructing the digital competence of pre-service teachers (SP CUT, SP TPK, SP SRD, SP CDL) has the strongest influence on their attitude to using technology (SP ATU) in the future?

D. Data collection procedure and analysis

The questionnaire was administered in paper to the study participants in the winter semester of the 2022 / 2023 academic year during the classes of the students with the researcher. Participation in the data collection procedure was voluntary. The questionnaire was anonymous and the time for its completion was about 15 minutes.

The collected data was statistically processed using the SSPS software (version 29). Firstly, in order to determine the reliability and validity of the instrument, the Cronbach's alpha was calculated for each of the variables. Secondly, we have used descriptive, inferential and correlational statistics to analyse the demographic data and the variables. We have computed the Skewness and Kurtosis of each deliverable to analyse the assumption of normality of the collected data. Along with that a multiple regression analysis was made to examine the relations between the different variables. Lastly, we applied a parametric (one-way ANOVA test) to determine the mean values of the bachelor and master level students on each of the variables and a homogeneity test on the variances (an ANOVA Levene's test for equality of variances) to test if there is equal variance for each variable calculated among the two groups of respondents (bachelor and master level students).

IV. RESULTS

A. Statistical descriptive analysis

To get a better understanding of the data obtained we calculated the mean (M), standard deviation (SD), Skewness and Kurtosis plus the Cronbach's alpha (α) of each of the variables (Table III).

TABLE III.   DESCRIPTIVE STATISTICS OF THE VARIABLES

Variable	M	SD	Skew-ness	Kurtosis	Cronbach's alpha (α)
SP CUT	3.85	0.52	-0.95	0.213	0.834
SP TPK	3.57	0.69	-0.74	-0.375	0.702
SP SRD	3.46	0.34	-0.33	-0.349	0.780
SP CDL	3.74	0.66	-0.80	-0.495	0.786
SP ATU	3.54	0.80	-0.79	-0.361	0.831

The descriptive analysis of the variables showed that the mean (M) ranges from 3.46 to 3.85 and the standard deviation (SD) was from 0.34 to 0.80, which is suggestive of a relatively narrow distribution of the responses of the study participants. The Kurtosis (ranging from -0.495 to 0.213) and Skewness (with a range from -0.95 to -0.33) also indicated a normal univariate distribution of the data since they were both within the acceptable range, i.e. the Kurtosis falls between the absolute values of 3 and 10 [18]. The reliability coefficient of each of the variables was also adequate as the Cronbach's alpha (α) was from 0.702 to 0.834 [18].

B. Correlational analysis

A correlational analysis was performed in order to give an answer to our first research question related to identifying the relations among the five variables based on the self-perceptions of the study sample of their digital competence.

The calculations of the Pearson correlation coefficient (r) for each pair of variables, showed that the variables with the strongest relationship were SP CUT and SP SRD (r = 0.896) followed by SP CUT and SP ATU (r = 0.867), while the variables least dependent on each other were SP SRD and SP CDL (r = 0.679) (Table IV).

TABLE IV.   CORRELATION COEFFICIENTS AMONG THE VARIABLES

	SP CUT	SP TPK	SP SRD	SP CDL	SP ATU
SP CUT	1	0.826**	0.896**	0.861**	0.867**
SP TPK	0.826**	1	0.734**	0.778**	0.699**
SP SRD	0.896**	0.734**	1	0.679**	0.673**
SP CDL	0.861**	0.778**	0.679**	1	0.824**
SP ATU	0.867**	0.699**	0.673**	0.824**	1

** Correlation is significant at the 0.01 level (2-tailed)

Since we wanted to check whether there were differences between the bachelor and master level students in their self-assessment on the different variables comprising their digital competence, we performed a one-way ANOVA test (Table V).

TABLE V.   ONE-WAY ANOVA TEST (MULTIPLE COMPARISONS AMONG THE BACHELOR AND MASTER LEVEL STUDY SUBJECTS)

Variables	Level	N	M	SD	Std. Error	F (between groups)
SP CUT	Bachelor	62	3.76	0.56	0.07	9.238
	Master	20	4.15	0.17	0.04	
SP TPK	Bachelor	62	3.41	0.70	0.09	16.156
	Master	20	4.07	0.39	0.09	
SP SQD	Bachelor	62	4.10	0.30	0.04	2.920
	Master	20	3.95	0.42	0.09	
SP CDL	Bachelor	62	3.59	0.68	0.09	15.478
	Master	20	4.20	0.29	0.06	
SP ATU	Bachelor	62	3.41	0.86	0.11	6.630
	Master	20	3.93	0.41	0.09	

* $p < 0.001$

The comparison of the means of the two groups of study respondents on each of the variables revealed that the master students reported higher mean values in all deliverables compared to the bachelor students with the exception of SP SRD, where the undergraduate study subjects had slightly higher values (M = 4.10, SD = 0.30) than the postgraduate study subjects (M = 3.95, SD = 3.95). The variables with the highest means for the bachelor level students were SP SRD (M= 4.10, SD = 0.30), SP CUT (M = 3.76, SD = 0.56) and SP CDL (M = 3.59, SD = 0.68), while the master students self-assessed themselves higher in terms of their SP CDL (M = 4.20, SD = 0.29), SP CUT (M = 4.15, SD = 0.17) and SP TPK (M = 4.07, SD = 0.39). Both groups self-assessed their attitude towards the use of digital technologies (SP ATU) lower compared to all other variables.

A subsequent Levene's test was used to test the homogeneity of variances between the two groups of study subjects. Since p = 0.021 (p < 0.05) we concluded that the data spread was equal.

C. Inferrential analysis

The performed inferential statistical analysis provided an answer to the second research question related to identifying which of the variables constructing the digital competence of the study subjects (SP CUT, SP TPK, SP SRD, SP CPL) had the strongest influence on their attitude to use technology (SP ATU) in their future careers as L2 teachers (Table VI).

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta (β)		
1 (Constant)	2.188	0.581		3.751	< 0.001
SP CUT	1.480	0.186	0.675	5.644	< 0.001
SP TPK	0.152	0.112	0.131	1.350	< 0.001
SP SRD	0.169	0.127	0.071	1.328	< 0.001
SP CDL	0.410	0.131	0.337	3.141	< 0.001
Information about the Model	$F_{(4.77)} = 69.854$, $R^2 = 0.784$, $p < 0.001$				

Dependent variable: SP ATU

The results from the multiple regression analysis revealed that the variable with the highest unstandardized beta value was SP CUT (B = 1.480, p < 0.001) followed by SP CDL (B = 0.410, p < 0.001) and SP SRD (B = 0.169, p < 0.001). This suggested that the strongest predictor for the possible future integration of ICT technologies and tools in the L2 classroom of the study participants was their Self-assessed competence for using and integrating digital technologies in the L2 teaching and learning process (SP CUT). The Self-perceived attitude of the study sample towards the use of digital technologies (SP ATU) was least dependent on their Self-perceived technological pedagogical knowledge (SP TPK).

V.   DISCUSSION

The results of the study regarding the first question indicate that the variables which are most strongly associated are the self-perceived competence of pre-service L2 teachers for integrating ICT in L2 instruction (SP CUT) and the self-perceived support received during training (SP SRD). These results correspond to research data of previous studies on the positive interrelation between pre-service teachers' ICT capacity and the demonstrations on how to integrate digital tools in the L2 classroom, on the hands-on experience and support received from course tutors and peers during their university training [9, 10, 19].

The second pair of variables that are found to be strongly related are the self-perceived competence of the study subjects for integrating ICT in L2 instruction (SP CUT) and their self-perceived attitude towards the use of digital technologies in their future teaching career (SP ATU). These results comply with the data of recent research studies on the relation between these two variables [19, 20].

Contrary to our initial expectations, the results reveal that the variables with the lowest association are the self-perceived support received during training (SP SRD) and the self-perceived capacity to promote the digital skills of L2 learners (SP CDL). It is difficult to give a logical explanation of that because research data support the positive relation between candidate teachers' self-efficacy in using technology (gained during their studies at university) and their skills in developing the digital competence of their learners [10, 20]. One possible interpretation is the assumed low level of knowledge and skills which some of the L2 pre-service teachers might

have with regard to incorporating digital learning activities and resources in the English language instruction. But it is also possible to approach the result from a different perspective. Given the fact that all study subjects are digital natives (their mean age is 23) who are trained to become teachers of another generation of digital natives, it could be supposed that the study respondents consider their young L2 learners as digitally literate individuals who do not need any additional training on how to use technology. Although this seems quite an unreasonable claim since digital natives are by no means sophisticated users of digital technology, it could be the reason behind a small percentage of the answers.

A detailed consideration of the interplay of the variables comprising the digital competence of the bachelor and master level study participants shows that the master students have higher means on the different variables than the bachelor students. This is indicative of the fact that they self-assess their mastery with digital technologies higher compared to the bachelors. The means of the master level students on the examined variables create the perception that they feel themselves better equipped in promoting the digital skills of L2 learners (SP CDL) and integrating ICT in L2 instruction (SP CUT) than the bachelor level students, who in turn value high the support received during training (SP SRD) and their competence in integrating ICT in L2 instruction (SP CUT). It is difficult to comment on these data in the light of available research as most of the recent studies examine the levels of digital competence mostly of undergraduate pre-service teachers [10, 19, 21]. The experience which the master students have gained with digital technologies during their undergraduate pedagogical training is most probably the main reason prompting them to consider themselves better skilled than the bachelors.

Interestingly, the self-perceived attitude of the study respondents towards the integration of digital technologies (SP ATU) is the variable that is ranked lowest by both the bachelor and the master level students. A plausible explanation for that could be the fact that the two groups of study participants perceived their abilities in engaging with digital technologies for professional purposes more important than their attitude towards implementing digital tools and resources in the educational process. This does not indicate that the study participants will not adopt new technology in their pedagogical encounters, but that they have valued it less than all other variables comprising their digital competence.

Regarding our second research question, the data prove that the pre-service teachers' self-perceived competence for integrating ICT in L2 instruction (SP CUT) is the strongest predictor for the positive attitude and intention of the study respondents towards implementing ICT-based technologies in their L2 classrooms. This complies with results of a number of studies which have established the strong relation between these two variables [19, 20]. It is important to note that although we have not examined the interrelation between the perceived usefulness of the technology and perceived ease of use [15], we cannot state whether they have any influence of the attitude of the study participants and on their intentions on using digital technologies in their

profession. This will be an issue under analysis in our future studies on the topic.

Although some prior studies [20, 22] have demonstrated that the adoption of TPACK training modules or courses in language teacher preparation programmes increase future L2 teachers' inclination to engage with digital technologies and facilitate their actual incorporation in class, our results contradict them. It is established that L2 pre-service teachers' attitude towards integrating digital technologies in language instruction is least dependent on their Self-perceived technological pedagogical knowledge (SP TPK). This implies that the attitude of pre-service teachers towards digital technologies depends more on their capabilities of using digital tools and applications, rather than on the implementation of the four components of the TPACK model in the pedagogical training of candidate teachers. In any case, these results do not imply that the pre-service teachers do not need consistent technological pedagogical training.

VI. LIMITATIONS OF THE STUDY

The use a self-assessment instrument creates conditions for subjectivity in the self-evaluation performed by the study subjects which could have a negative effect on the reliability and validity of the data. Therefore, future research could include focus group interviews with the study subjects, open-ended questions or an observation and assessment of their actual digital competences in the L2 teaching and learning process.

A second limitation of the reported study is a result from the methodological decision of the researchers to exclude gender as a variable determining the digital competence of the study subjects due to small percentage of male respondents (7.32 %). This limitation could hardly be addressed in our future research since male students constitute a small proportion of all students in the pedagogical programmes.

VII. CONCLUSION

The results of the study shed light on the interplay of the five variables on the digital competence of L2 pre-service teachers and their attitude towards the use of digital technologies in their L2 classrooms. The major implication that arises from this research is that self-efficacy plays a crucial role in the development of L2 teacher trainees' digital competence and positive intention to the implementation of ICT tools and applications in their future pedagogical practice.

We hope that this study would serve as a benchmark for future research on the topic and a starting point for rethinking the quality of digital training of future language teachers on a national level.

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