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# ASSISTIVE TECHNOLOGY IN INCLUSIVE EDUCATION: PERSPECTIVES OF SPECIAL EDUCATORS AND TEACHERS FROM SERBIA AND BOSNIA AND HERZEGOVINA

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**Abstract.** The study aims to determine the current level of implementation of assistive technology (AT) in educational environment and to identify key factors such as teachers‘ attitudes, knowledge and experience regarding AT. Therefore, a cross-sectional study was conducted with 145 teachers from mainstream and special schools in Bosnia and Herzegovina and Serbia. Data were collected using translated and adapted questionnaires and analyzed using descriptive and inferential statistical methods. The results indicate an absence of statistically significant correlations between teachers‘ work experience, prior knowledge, workplace and teachers‘ readiness to implement AT. High costs and the need for additional training remain the primary barriers to wider implementation, although attitudes regarding the usefulness of AT are highly positive. To improve AT implementation, challenges such as lack of training, resources and awareness must be addressed through targeted training programs and institutional support on a national level.

*Keywords:* special educational needs; assistive technology; education; experience; knowledge; teachers

## Introduction

In the contemporary digital era of inclusive education, access to assistive technology (AT) has become both a crucial tool and a key indicator of educational equity (Fernández-Batanero & Colmenero-Ruiz, 2016), and has revolutionized the

process of learning for students with special educational needs (hereafter referred to as SEN) during the past three decades (Ismaili & Ibrahimi, 2016). One of the most widely accepted definitions of AT, which continues to reflect its essential purpose, was introduced in The Individuals with Disabilities Education Act Amendments (IDEA)[1] defining AT as, "any item, piece of equipment, or product system, whether acquired commercially, off the shelf, modified, or customized, that is used to increase, maintain, or improve the functional capabilities of children with disabilities" – 20 U.S.C. §1401. However, AT cannot be viewed exclusively as hardware or a software component but rather as a symbol of empowerment, hope and encouragement for students with disabilities who require modifications or additional support in order to overcome challenges in everyday functioning (Akpan & Beard, 2013). AT, also referred to in the literature as supplementary aids and/or services (Parette & Murdick, 1998), offer a broad spectrum of solutions from entry-level tools to highly personalized and advanced support systems. Due to the complexity of these devices, users often require ongoing training and support, as well as financial assistance (Mahmoudi-Dehaki et al., 2025). The European Union[2] (EU), throughout its legislation, directives and strategies establishes baseline standards for products and services, most notably through European Accessibility Act2). Complementing this, the Digital Education Action Plan promotes principles of universal design for learning, accessibility, and availability of AT in the educational systems of EU member states and EU candidate countries (Marchisio et al., 2021). Republic of Serbia and Bosnia and Herzegovina, as potential EU candidates undergoing transitional educational reforms, are obliged to align their policies with these guidelines (Rakocevic, Benkovic & Milosevic, 2016). This includes the development and implementation of AT and the creation of accessible educational environment. In addition, UNESCO[3] has recognized the importance of educating teachers regarding usage of information and communication technology (ICT) through the UNESCO ICT Competency Framework for Teachers. The framework offers potential benefits including standards regarding teacher competencies, improvement of teaching and learning process, enhancing student achievement and engagement in classroom using ICT as an instructional tool (Wang, 2013).

Even though the importance of AT is increasingly recognized in educational legislative and practice, its everyday implementation depends on many factors, including knowledge and attitudes of teachers themselves (Granger et al., 2002). In contemporary, technology-driven world, teachers must not only have strong theoretical knowledge but also the skills to effectively implement various technological tools into their teaching (Nayak & Pani, 2021). Unfortunately, some teachers do not support the use of AT and do not advocate for its implementation in educational process (Odović et al., 2018), for example a study conducted by Ahmed (2018) reflects that teachers hold moderately positive attitudes towards usage of AT in the educational environment. Teachers' attitudes toward AT are positively correlated

with its effective implementation - those with negative attitudes tend to avoid using it, whereas teachers with positive attitudes are more inclined to integrate it into their practice. Negative attitudes often have roots in lack of self-confidence in their own competencies, limited experience and insufficient support systems, especially when it comes to working with children with SEN (Odović et al., 2018). Without proper training, according to WHO[4] AT fails to deliver its expected benefits, often leading to improper use and eventual abandonment by users.

Sharpe (2010) identified the insufficient training as one of the most significant barriers to effective usage of AT. In the study 80.3% of surveyed teachers expressed a need for further professional development. Many had never received any formal training on the topic. Additionally, the training opportunities that are available are often considered outdated.

A review of current curricula at both public and private faculties of Special Education and Rehabilitation in Republic of Serbia (Novi Sad and Belgrade) and Bosnia and Herzegovina (Banja Luka, Tuzla, Istočno Sarajevo and Sarajevo) shows that there is a one- or two-semester course related to AT and Alternative and Augmentative Communication (AAK). Unfortunately, this subject has not been incorporated into the curricula of other teacher education faculties, which means that most educators from mainstream schools are not familiar with the available AT or its potential in the classroom environment. Therefore, the competence of educators regarding usage of AT is frequently being questioned due to lack of training in current education programs (Zhou et al., 2011).

Flanagan (2013) identifies several barriers which hinder the proper utilization of AT in education, including high price of AT devices (75%), the need for further training (47%), and challenges for teachers themselves (43%). Authors have also recognized the frequent need to replace devices due to growth and development of the child (Vinčić, 2016), as well as limited access and affordability in rural and suburban areas, leading to geographic disparities (Ismaili & Ibrahimi, 2016). At the institutional level, the absence of clear guidelines and strategies additionally limit the usage of AT in inclusive education (Mngo & Mngo, 2018).

Both Serbia and Bosnia and Herzegovina face similar challenges given the regional similarities in institutional, economic, political, and cultural conditions. Specifically this refers to lack of institutional support, underdeveloped policies, and inconsistent implementation of existing laws related to inclusive practices. Physical barriers, such as outdated infrastructure and restricted access to AT (for example absence of ramps, elevators, automatic doors, etc.) additionally contribute to the low prevalence and usage of AT in the educational environment (Ahmad, 2015). Furthermore, the lack of research on this topic in the regional context is also the source of potential for generating new insights and fertile ground for new discoveries. Through this study, the researchers aimed to gain insight into teachers' knowledge of AT, as well as their experiences and attitudes regarding its implementation.

## Materials and Methods

*Participants*

This study involved a total of 145 participants, including 85 teachers employed in mainstream schools and 60 teachers from special schools for the education of children with developmental disabilities. Schools from both Bosnia and Herzegovina and the Republic of Serbia participated in the study, with school principals voluntarily providing written consent for participation. The research was conducted in the following mainstream elementary schools, "Peta osnovna škola", "Čengić Vila 1", "Umihana Čuvidina", and one high school "Prva gimnazija" in Sarajevo, as well as in special education institutions for children with developmental disabilities, "Vladimir Nazor" Center, Center for Blind and Visually Impaired Children and Youth in Sarajevo, and "Sveti Sava" Elementary School in Šabac.

Two criteria were used for participant selection: (1) employment in either a mainstream school or a special school for children with developmental disabilities, and (2) for teachers working in mainstream schools, the presence of at least one student with developmental disabilities in their classroom.

*Instruments*

In order to examine teachers' experiences and the factors influencing the use of AT in educational environment, researchers of this study translated and adapted two questionnaires with the authors' permission. In addition, certain sections were supplemented and modified to better align with the specific goals of this research. The aforementioned questionnaires are: the standardized instrument "Teachers Knowledge and Use of Assistive Technology for Students with Special Educational Needs" by Keetam D.F. Alkahtani (2013), which measures the level of knowledge and education regarding AT, and the standardized instrument "Middle School Special Education Teachers' Perceptions and Use of Assistive Technology in Literacy Instruction" by Glanagan, Bouck and Richardson (2013) which focuses on the types of AT, factors that influence its implementation and/or abadonment. An online questionnaire was created using the Google Forms platform. Some questions allowed for a single response, while others offered multiple-choice options. The questionnaire also included open-ended questions and Likert-scale items ranging from "Strongly agree" to "Cannot determine." The final questionnaire consisted of 40 items divided into four sections, the first section gathered sociodemographic data, the second section focuses on teachers' competencies in using AT and factors that influence its use, the third section and fourth section, developed specifically for this research, provided additional insight beyond the standardized instruments using supplementary open-ended questions that allowed for a deeper qualitative analysis of the topic.

*Statistical Data Analysis*

The collected data were analyzed using the statistical software SPSS 20.0, using both methods of descriptive statistical analysis, in order to highlight

relevant distribution of responses, frequencies and percentages for variables, as well as comparative statistical methods such as Chi-square test of independece ($\chi^2$ test) and Fisher's exact test used as an alternative to the Chi-square test where expected frequencies were less than 5. The levels of statistical significanse were set at:

– $p < .05$ (statistically significant difference)
– $p < .01$ (highly statistically significant difference).

All results are presented in a table format followed by interpretation.

**Results**

*Sample description*

The sample consists of 145 teachers aged 25 to 65 years, predominantly female (87.6%). Participants are primarily from Bosnia and Herzegovina (70.3%). Almost all work in urban schools (97.3%), with very few in rural settings (2.7%) (Table 1). Regarding workplace, nearly half of the teachers are employed in mainstream schools (49%), while 38.6% work in schools dedicated to children with SEN. Most participants teach at the primary school level (72.4%), with fewer in secondary schools. The most frequently taught subjects include skills-based subjects (26.9%), natural sciences (25.5%), and native language (24.1%).

**Table 1.** Socio-Demographic Characteristics of the Sample

| **Sample description** | | |
|---|---|---|
| **Age range** | | 25 – 65 years |
| | ($\bar{x}$ ±SD) | 45±10 |
| **Gender (n, %)** | Male | 18 (12.4%) |
| | Female | 127 (87.6%) |
| | Total sample | 145 (100%) |
| **Level of education** | | |
| | Bachelor's degree | 97 (66.9%) |
| | Master's degree | 41 (28.3%) |
| | PhD | 4 (2.8%) |
| | Other | 3 (1.4%) |
| **Country of residence** | | |
| | Bosnia and Herzegovina | 102 (70.3%) |
| | Republic of Serbia | 43 (29.7%) |
| **School location** | | |
| | Rural area (village) | 4 (2.7%) |
| | Urban area (city) | 141 (97.3%) |
| **Years of experience** | | |

| | | |
|---|---|---|
| | Less than one year | 10 (6.9%) |
| | 1 – 2 years | 23 (15.9%) |
| | 3 – 5 years | 23 (15.9%) |
| | 6 – 9 years | 17 (11.7%) |
| | 10 – 20 years | 49 (33.8%) |
| | More than 20 years | 23 (15.9%) |
| **Job description (Workplace)** | | |
| | Teacher in the mainstream school | 71 (49%) |
| | Teacher in a school for children with SEN | 56 (38.6%) |
| | Other | 18 (12.4%) |
| **Grade level taught** | | |
| | Primary School | 105 (72.4%) |
| | Secondary School | 28 (19.3%) |
| | Teacher of multiple grade levels | 12 (8.3%) |
| **Subject** | | |
| | Native language | 35 (24.1%) |
| | Mathematics | 32 (22.1%) |
| | Foreign languages | 17 (11.7%) |
| | Natural sciences | 37 (25.5%) |
| | Social sciences | 25 (17.2%) |
| | Skills | 39 (26.9) |
| | Elective subjects | 12 (8.3%) |
| | Individual special education support | 31 (21.4%) |
| | Other | 25 (17.2%) |
| **Number of children with SEN in the classroom** | | |
| | 1 – 2 | 64 (44.1%) |
| | 3 – 5 | 32 (22.1%) |
| | 6 and more | 49 (33.8%) |

*SEN – Special educational needs

*Teachers' Self-Estimation of Preparedness and Informedness about AT*

In response to the question of whether they had the opportunity to take a course about AT during their formal education, 47.6% of teachers answered affirmatively (Table 2). Regarding the use of any form of AT in their educational practice, 70.3% stated that they had implemented AT in some form. Surprisingly, 48.3% of respondents indicated that they were familiar with the concept but had not had the opportunity to apply it in practice. As for their self-assessed level of knowledge, the largest proportion of teachers (38.6%) rated their knowledge as moderate or basic whilst only 4.8% described themselves as having extensive knowledge in this field. In terms of formal training, 41.4% of teachers reported that they had not attended any workshops or seminars related to AT. However, interest in further education is high, as 81.4% of respondents expressed a strong interest in pursuing additional training and professional development in the field of AT.

**Table 2.** Teachers' self-estimation of preparedness and informedness about AT

| Question | Response | number (%) |
|---|---|---|
| **Years of experience in implementing AT** | | |
| | Less than one year | 65 (44.8%) |
| | 2 – 4 | 33 (22.8%) |
| | 5 – 10 | 16 (11%) |
| | 11 – 20 | 12 (8.3%) |
| | No experience | 14 (9.7%) |
| **During your formal education, did you have the opportunity to attend a lecture or course on AT?** | | |
| | Yes | 69 (47.6%) |

| | | |
|---|---|---|
| | No | 76 (52.4%) |
| **Do you currently implement AT in your classroom?** | | |
| | Yes | 102 (70.3%) |
| | No | 43 (29.7%) |
| **Did you have any knowledge of AT before you started using it in your classroom?** | | |
| | I had prior knowledge about AT | 41 (28.3%) |
| | I did not have prior knowledge about AT | 34 (23.4%) |
| | I was familiar with the concept of AT, but had not used it | 70 (48.3%) |
| **How would you rate your current level of knowledge regarding AT?** | | |
| | I have no knowledge | 9 (6.2%) |
| | I have very little knowledge | 44 (30.3%) |
| | I have some knowledge | 56 (38.6%) |
| | I have good knowledge | 29 (20%) |
| | I have extensive knowledge | 7 (4.8%) |
| **How many workshops or seminars related to AT have you attended?** | | |
| | None | 60 (41.4%) |
| | 1 – 2 | 58 (40%) |
| | 3 – 4 | 18 (12.4%) |
| | 5 or more | 9 (6.2%) |

| | | |
|---|---|---|
| **Are you interested in further education and professional development in the field of AT?** | | |
| | Yes, I am very interested | 118 (81.4%) |
| | I am not sure, I would need to think about that | 27 (18.6%) |
| | No, I am not interested | 0 (0%) |
| **Which learning styles would you prefer for training on AT? (Select all that apply)** | | |
| | One-on-one instruction | 72 (49.7%) |
| | Practical group sessions | 98 (68.6%) |
| | Educational workshops | 99 (68.3%) |
| | Seminars | 74 (51%) |
| | Other | 1 (0.7%) |

*Teachers' attitudes and ther inclitation toward implementing AT in educational settings*

The majority of respondents (84.8%) answered affirmatively to the question whether students in their schools are using some kind of AT devices (Table 3). Regarding the integration of AT into the Individualized Education Plan (IEP), 80% of teachers stated that the IEP team does include the usage of AT. When asked whether they personally use AT in their educational work, 44.8% of teachers responded that they use it regularly. As for their readiness to apply assistive technology in working with students, the largest percentage of teachers (51%) stated that they were willing to give it a try.

**Table 3.** Prior teachers' experience and implementation of AT in educational settings

| Question | | Number (%) |
|---|---|---|
| **Do pupils in your school use AT devices?** | | |
| | Yes | 123 (84.8%) |
| | No | 22 (15.2%) |

| | | |
|---|---|---|
| **Does IEP team integrate the utilization of AT in IEP?** | | |
| | Yes | 116 (80%) |
| | No | 29 (20%) |
| **Do you implement the usage of AT in your everyday work with children?** | | |
| | Yes | 65 (44.8%) |
| | No | 23 (15.9%) |
| | Sometimes | 56 (39.3%) |
| **Do you feel ready to implement the services from the domain of AT field?** | | |
| | I am not ready<br>I am ready, but I do not know how | 4 (2.8%)<br>28 (19.3%) |
| | I am ready to try | 74 (51%) |
| | I am extremely ready | 39 (26.9%) |

Over 90% of respondents believe that AT has a positive impact on student achievement and 93.8% of respondents agreed that AT helps teachers tailor instruction to meet the specific needs of students (Table 4). Furthermore, more than 63% of teachers disagreed with the statement that the implementation of AT in the school environment creates stress and should not be mandatory. Regarding the claim that the use of AT in classrooms requires additional time and slows down the learning process, only 11.7% of respondents expressed agreement.

**Table 4.** Teachers' attitude and inclination towards AT

| ***Item*** | **I agree** | **I do not agree** | **I cannot define** |
|---|---|---|---|
| Do you agree that utilization of AT has a positive impact on **student achievements**? | 131 (90.3%) | 0 (0%) | 14 (9.7%) |
| Do you think that AT helps teachers to **tailor instruction** to meet the specific needs of the students? | 139 (93.8%) | 0 (0%) | 9 (6.2%) |
| Do you think that application of AT in educational settings is **stressful** and should **not be mandatory?** | 13 (9%) | 92 (63.4%) | 40 (27.6%) |
| Do you agree that the use of AT in the classroom requires **additional time and slows down the pace of learning**? | 17 (11.7%) | 70 (48.3%) | 58 (40%) |

The majority of teachers (83.4%) reported that the training they had received in AT was useful, while a smaller proportion (16.6%) did not find the training beneficial. When examining the types of AT available in schools, the majority consists of low-tech devices (79.3%), followed by mid-tech devices (43.4%), while only 15.2% of schools have access to high-tech AT. This distribution highlights a significant reliance on basic support tools, with advanced technological solutions remaining relatively scarce across educational institutions.

The most frequently reported factors supporting the use of AT include its potential to enhance learning outcomes and its capacity to provide daily support to students (69.7%) (Table 5). The most frequently reported barrier to the use of AT is its high cost. The second most significant obstacle is the need for additional training, followed by a lack of sufficient knowledge to effectively implement AT in educational settings.

**Table 5.** Factors influencing the Use and Non-Use of AT

| Factors influencing the usage of AT | % | Barriers to the implementation of AT | % |
|---|---|---|---|
| **Increases learning opportunities** | 111 (76.6%) | Too expensive | 98 (67.9%) |
| **Provides daily assistance to students** | 101 (69.7%) | Requires additional training | 95 (65.5%) |
| **Can be used individually or in groups** | 98 (67.6%) | Lack of knowledge about AT | 65 (44.8%) |
| **Easily provides information to the student** | 71 (49%) | School computers do not support AT | 41 (28.3%) |
| **Easy to learn how to use** | 65 (44.8%) | Requires additional time for setup and usage | 32 (22.1%) |
| **Easy and flexible to set up** | 30 (20.7%) | Pupils have difficulties using AT | 23 (15.9%) |
| **Other** | 4 (2.76%) | Difficult to use during lectures | 20 (13.8%) |
| | | Other | 10 (6.9%) |

*Testing the hypotheses*

Chi-square test of independence was used in order to examine whether years of professional experience influence the implementation of assistive technology (AT) in educational settings. The results, presented in Table 6, indicate that there is no statistically significant correlation between years of work experience and the use of assistive technology in working with children with developmental disabilities, $\chi^2(10) = 1.38$, df=10, $p = .999$.

**Table 6.** Correlation between years of work experience and implementation of AT in educational settings

| Parameter | | Do you implement AT in your everyday work? | | | χ2 | p-level |
|---|---|---|---|---|---|---|
| | | *Yes* | *No* | *Sometimes* | | |
| | | Number (%) | Number (%) | Number (%) | | |
| Years of work experience | *Less than one year* | 4 (40.0%) | 2(20.0%) | 4 (40.0%) | 1.38 | .999 |
| | *1 – 2 years* | 10 (43.5%) | 4 (17.4%) | 9 (39.1%) | | |
| | *3 – 5 years* | 10 (43.5%) | 4(17.4%) | 9 (39.1%) | | |
| | *6 – 9 years* | 7 (41.2%) | 3 (17.6%) | 7 (41.2%) | | |
| | *10 – 20 years* | 22 (44.9%) | 8 (16.3%) | 19 (38.8%) | | |
| | *More than 20 years* | 12 (52.2%) | 2 (8.7%) | 9(39.1%) | | |

A Chi square test of independence was also used to determine whether prior knowledge of AT is associated with teachers‘ readiness to implement AT-related services in educational settings. The results, presented in the Table 7, suggest that there is no statistically significant relationship between the two variables $\chi 2=8.92$, df=6, p=.178.

**Table 7.** Correlation between prior AT-related knowledge and teachers' readiness to implement AT-related services in educational settings

| Parameter | Teachers‘ level of readiness to implement AT-related services | | | | χ2 | p-level |
|---|---|---|---|---|---|---|
| | I am not ready | I am ready but I do not know how | I am ready to try | I am extremely ready | | |
| | n(%) | n(%) | n(%) | n(%) | | |
| | | | | | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Prior AT knowledge** | I have prior knowledge | 5 (12.2%) | 10 (24.4%) | 20 (48.8%) | 6 (14.6%) | 8.92 | .178 |
| | I do not have prior knowledge | 2 (5.9%) | 8 (23.5%) | 18 (52.9%) | 6 (17.6%) | | |
| | I was familiar with the concept | 7 (8.8%) | 10 (12.5%) | 36 (45.0%) | 27 (33.8%) | | |

A Chi-square test of independence was conducted in order to determine whether a statistically significant relationship exists between the level of assistive technology (AT)-related knowledge and teachers‘ workplace. The results, presented in Table 8, indicate no statistically significant correlation between the two variables, $\chi^2(8) = 0.22$, $p = .9999$.

**Table 8.** Correlation between workplace and teachers‘ readiness to implement AT devices

| **Parameter** | | **Teachers‘ readiness to implement AT devices** | | | | | **$\chi^2$** | **p val.** |
|---|---|---|---|---|---|---|---|---|
| **Teachers’ workplace** | | I have no knowledge | I have very little knowledge | I have some knowledge | I have good knowledge | I have extensive knowledge | .22 | .999 |
| | | Number (%) | Number (%) | Number (%) | Number (%) | Number (%) | | |
| | Mainstream school | 4 (5.7%) | 22 (33.4%) | 27 (38.6%) | 14 (20.0%) | 3 (4.3%) | | |
| | SEN School | 3 (5.4%) | 17 (30.4%) | 22 (39.3%) | 11 (19.6%) | 3 (5.4%) | | |
| | Other | 1 (5.6%) | 5 (27.8%) | 7 (38.9%) | 4 (22.2%) | 1 (5.6%) | | |

**SEN – special educational needs*

Fisher's exact test for independent samples was applied in order to examine whether there is a significant difference in positive attitudes regarding the use of AT in educational practice between mainstream school teachers and teachers working in schools for children withSEN. The results showed no statistically significant difference between the two groups (Table 9). Additionally, the analysis revealed no statistically significant correlation between teachers' expressed need for additional training in assistive technology and their attitudes toward its use in the educational process.

**Table 9.** Results of Fisher's exact test for independent samples

| **Parameter** | | **Implementation of AT has a positive impact on student achievements** | | | ***χ2*** | ***p-level*** |
|---|---|---|---|---|---|---|
| | | I agree | I do not agree | I cannot define | 0,080 | 0,961 |
| | | Number (%) | Number (%) | Number (%) | | |
| **Teachers' workplace** | *Mainstream school* | 64 (90.1%) | 0 (0%) | 7(9.9%) | | |
| | *SEN school* | 51 (91.1%) | 0 (0%) | 5(8.9%) | | |
| | *Other* | 16 (88.9%) | 0 (0%) | 2(11.1%) | | |
| **Parameter** | | Do you think that application of AT in education settings is stressful and should not be mandatory? | | | *χ2* | *p-level* |
| **Shown interested in further educatioand professional development regarding AT** | | I agree | I do not agree | I cannot define | .081 | .960 |
| | | Number (%) | Number (%) | Number (%) | | |
| | Yes, I am very interested | 11 (9.2%) | 75 (63%) | 33 (22.7%) | | |
| | I do not know, I will think about that | 2 (7.7%) | 17 (65.4%) | 7 (26.9%) | | |
| | Not at all interested | 0 (0%) | 0 (0%) | 0 (0%) | | |

**Discussion**

Although the study includes participants from two countries, the analysis was not designed to emphasize cross-country differences. This approach is grounded in the fact that Serbia and Bosnia and Herzegovina share highly comparable legislative frameworks, models of inclusive education, as well as a similar level of development in this field. Therefore, the findings are interpreted as reflecting general trends within a broadly homogeneous educational context rather than country-specific variations.

Results of this research confirm the findings of previous studies which indicate a limited level of teachers' knowledge and experience in the use of AT, as well as the presence of numerous institutional and policy related barriers that hinder its broader implementation in the educational practice (Flanagan et al., 2013; Bruinsma et al., 2013; Vuković, 2018; Jovanović-Simić et al.,2019). However, a significant contribution of this study lies in a deeper understanding of the relationship between teachers' knowledge, attitudes, and intentions to use AT, which can be interpreted through relevant theoretical models of acceptance of AT in educational environment.

The insufficient use of AT can be explained within the framework of the Technology Acceptance Model (TAM) which highlights perceived usefulness and perceived ease of usage the device are key predictors to technology acceptance (Davis, 1989; Saadé & Bahli, 2005). Although our respondents recognize the potential of AT in improving educational outcomes for students with developmental disabilities, low levels of training and limited practical experience negatively affect the perceived ease of usage, hence reducing the actual frequency of AT use in practice. These findings are consistent with the results of Flanagan (Flanagan et al., 2013) and Bruinsma (Bruinsma et al., 2013). Their results indicate that positive attitudes alone are not sufficient for implementation of AT if they are not followed by adequate competencies of the relevant actors.

Besides, the results can also be interpreted through the concept of the teachers' self-efficacy. Teachers who lack sufficient knowledge and experience regarding the use of AT often show insecurity in their own abilities, which may lead to avoidance of its use, regardless of their positive attitudes toward the technology itself. Even though a large percentage of teachers support the implementation of AT in IEP, a significant number of them do not use AT regularly in their everyday teaching practice. Similar findings are reported also by Jovanović-Simić et al. (2019), who highlight that a lack of competencies directly contributes to reduced professional confidence among teachers whilst working with AT devices.

In addition, the lack of correlation between the years of work experience and the use of AT confirms that experience alone is not a key factor in adoption of technological innovations. This finding can be explained through Rogers' Diffusion of Innovations Theory which explain that adoption of AT is a complex social process influenced by a lot of different factors such as previous exposure to

innovations, availability of institutional support and peer influence, the perception of relative advantage of AT usage, and not just professional tenure (Riemer-Reiss, 1999; Rogers, 2003; Dibra, 2015). Younger teachers, who were frequently exposed to modern technologies during their initial education may adopt AT more readily, whereas older teachers who rather used entry-based level devices and tools during their education may remain in the group of late adopters or even exhibit resistance to innovation (Zhou et al., 2012).

Furthermore, lack of statistically significant differences between teachers from mainstream and special schools in terms of knowledge and ability to use AT devices suggest that institutional context alone is not a sufficient predictor of professional competence. This finding can be interpreted through TPACK framework, which emphasizes that effective usage of technology requires integration of technological, pedagogical and content knowledge (Mishra & Koehler, 2006; Marino et al., 2009). If professional training is not systematically organized and oriented toward the development of integrated competencies, teachers in special education settings do not necessarily develop higher levels of expertise, which is consistent with the findings of the conducted study but differs to some extent from the findings of Jovanović-Simić et al. (2019).

Another significant finding of this study is related to the fact that teachers predominatly use low-tech forms of AT. This pattern of usage may be interpreted as a result of combination of lack of financial resources, lack of training, and higher perceived ease of implementation of low-tech solutions. Similar resoults are consistent with the studies conducted by Vincic et al. (2020), which also indicate that low-tech AT devices are the most commonly used in work with students with developmental disabilities.

Despite the identified barriers, the results indicate strong teacher motivation and predominatly positive attitudes toward AT, which represents an important potential for the future development of inclusive practice. Bruinsma et al. (2013) also highlight the fact that the expressed need for additional training does not reflect a negative perception of AT, but rather teachers' awareness of their own professional limitations and their eagerness to pursue further professional development and make use of available learning opportunities as they arise.

**Conclusion**

Based on the obtained findings, it can be concluded that the implementation of AT in the educational environment of students with developmental disabilities is not primarily limited by teachers' attitudes, but rather by the lack of institutional support, continuity in professional development and underdeveloped teachers' self-efficacy. This study conceptually highlights that positive attitudes toward AT are necessary but also insufficient for the successful and meaningful implementation of AT. Effective integration of AT requires coordinated and simultaneous actions

on different 'fronts', such as at the individual level (knowledge and self-efficacy), institutional level (training programs and infrastructure) and state level (legislative, conducting legislative on a practical level and funding). This represents the central message of the study, emphasizing the need for comprehensive, multi-level approaches in order to understand and address the challenges of inclusive education in the regional context.

**NOTES**

1. Individuals with Disabilities Education Act, Pub. L. No. 101 – 476, 104 Stat. 1142 (1990).
2. European Parliament and Council, EUR-Lex. (2019). Directive (EU) 2019/882 of the European Parliament and of the Council of 17 April 2019 on the accessibility requirements for products and services (Text with EEA relevance), Official Journal of the European Union, L 151, 70 – 115. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32019L0882
3. UNESCO. (2018). UNESCO ICT competency framework for teachers. https://www.unesco.org/en/digital-competencies-skills/ict-cft
4. World Health Organization. (2024). Assistive Technology. Who.int; World Health Organization: WHO. https://www.who.int/news-room/fact-sheets/detail/assistive-technology

**REFERENCES**

Ahmad, F. K. (2015). Use of assistive technology in inclusive education: making room for diverse learning needs. *Transcience, 6*(2), 62 – 77.

Ahmed, A. (2018). Perceptions of Using Assistive Technology for Students with Disabilities in the Classroom. *International Journal of Special Education, 33*(1), 129 – 139.

Akpan, J., & Beard, L. (2013). Overview of assistive technology possibilities for teachers to enhance academic outcomes of all students. *Universal Journal of Educational Research, 1*(2), 113 – 118.

Alkahtani, K. D. F. (2013). Teachers' Knowledge and Use of Assistive Technology for Students with Special Educational Needs. *Journal of Studies in Education, 3*(2). https://doi.org/10.5296/jse.v3i2.3424.

Bruinsma, M., Van der Veen, I., & Peetsma, T. (2013). Teachers' attitudes toward assistive technology in inclusive education. *International Journal of Inclusive Education, 17*(6), 615 631. https://doi.org/10.1080/13603116.2012.687000.

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly, 13*(3), 319 – 340. https://doi.org/10.2307/249008.

Dibra, M. (2015). Rogers Theory on Diffusion of Innovation-The Most Appropriate Theoretical Model in the Study of Factors Influencing the Integration of Sustainability in Tourism Businesses. *Procedia – Social and Behavioral Sciences*, *195*, 1453 – 1462. https://doi.org/10.1016/j.sbspro.2015.06.443.

Fernández-Batanero, J. M., & Colmenero-Ruiz, M. J. (2016). ITC and Inclusive Education: Attitudes of the teachers in secondary education. *Journal of Technology and Science Education, 6*(1), 19 – 25. https://doi.org/10.3926/jotse.208.

Flanagan, S., Bouck, E. C., & Richardson, J. (2013). Middle school special education teachers‘ perceptions and use of assistive technology in literacy instruction. *Assistive technology: the official journal of RESNA, 25*(1), 24 – 30. https://doi.org/10.1080/10400435.2012.682697.

Granger, C. A., Morbey, M. L., Lotherington, H., Owston, R. D., & Wideman, H. H. (2002). Factors contributing to teachers' successful implementation of IT. *Journal of Computer Assisted Learning*, *18*(4), 480 – 488. https://doi.org/10.1046/j.0266-4909.2002.00270.x.

Ismaili, J., & Ibrahimi, E. H. O. (2016). Mobile learning as alternative to assistive technology devices for special needs students. *Education and Information Technologies*, *22*(3), 883 – 899. https://doi.org/10.1007/s10639-015-9462-9.

Jovanović-Simić, J., Golubović, Š., & Jevtić, B. (2019). Teachers' competencies for the use of assistive technology in inclusive education. *Special Education and Rehabilitation, 18*(2), 123 – 140. https://doi.org/10.5937/specedreh18-XXXXX.

Mahmoudi-Dehaki, M., Nasr-Esfahani, N., & Vasan, S. (2025). *The Transformative Role of Assistive Technology in Enhancing Quality of Life for Individuals With Disabilities*. In: R. Pandey, P. Maurya, J. Prajapati, R. Halder, & K. Tyagi (Eds.), *Assistive Technology Solutions for Aging Adults and Individuals With Disabilities* (pp. 45 – 72). IGI Global Scientific Publishing. https://doi.org/10.4018/979-8-3693-6308-9.ch003.

Marchisio, M., Barana, A., Fissore, C., & Pulvirenti, M. (2021). Digital Education to Foster the Success of Students in Difficulty in Line with the Digital Education Action Plan. *EDEN Conference Proceedings,* 1, 353 – 363. https://doi.org/10.38069/edenconf-2021-ac0034.

Marino, M., Sameshima, P. & Beecher, C. (2009). Enhancing TPACK with Assistive Technology: Promoting Inclusive Practices in Pre-service Teacher Education. *Contemporary Issues in Technology and Teacher Education, 9*(2), 186 – 207.

Mishra, P., & Koehler, M. J. (2006). Technological pedagogical content knowledge: A framework for teacher knowledge. *Teachers College Record, 108*(6), 1017 – 1054.

Mngo, Z. Y., & Mngo, A. Y. (2018). Teachers' Perceptions of Inclusion in a Pilot Inclusive Education Program: Implications for Instructional Leadership. *Education Research International, 2018*, 1 – 13. https://doi.org/10.1155/2018/3524879.

Nayak, S., & Pani, P. (2021). Teacher competence and 21st century challenges: A critical analysis of existing teacher competency frameworks. *Turkish Online Journal of Qualitative Inquiry, 12*(6), 382.

Odović, G., Bakoč, A., & Rakić, I. (2018). *Advantages of using assistive technology in the education of students with developmental disabilities. In Education of children and students in inclusive settings: Thematic proceedings of international significance*. Society of Special Educators and Rehabilitators of Vojvodina.

Parette, H. P., & Murdick, N. L. (1998). Assistive technology and IEPs for young children with disabilities. *Early Childhood Education Journal*, *25*, 193 – 198.

Rakocevic, S. B., Benkovic, S., & Milosevic, N. (2016). *Cooperation and strategy in higher education: evidence from Serbia*. Toulon-Verona Conference.

Riemer-Reiss, M. L. (1999). Applying Rogers' diffusion of innovations theory to assistive technology discontinuance. *Journal of Applied Rehabilitation Counseling, 30*(4), 16 – 21.

Rogers, E. M. (2003). *Diffusion of innovations* (5th ed.). Free Press.

Saadé, R., & Bahli, B. (2005). The impact of cognitive absorption on perceived usefulness and perceived ease of use in on-line learning: an extension of the technology acceptance model. *Information & Management, 42*(2), 317 – 327. https://doi.org/10.1016/j.im.2003.12.013.

Sharpe, M. (2010). *Assistive Technology Attrition: Identifying Why Teachers Abandon Assistive Technologies*. Doctoral dissertation. Nova Southeastern University.

Vinčić, I. (2016). *Availability and use of assistive technology in the education of children with motor impairments and chronic illnesses in the Republic of Croatia*. University of Zagreb.

Vuković, M. (2018). Teachers' attitudes toward the use of assistive technology in inclusive instruction. *Pedagogija, 73*(4), 567 582.

Wang, S. H. (2013). *ICT Competency Framework and Training Strategies. Applied Mechanics and Materials*, 380 – 384, 1977 – 1981. https://doi.org/10.4028/www.scientific.net/amm.380-384.1977.

Zhou, L., Smith, D. W., Parker, A. T., & Griffin-Shirley, N. (2011*). Assistive technology competencies of teachers of students with visual impairments: A comparison of perceptions. Journal of Visual Impairment & Blindness, 105*(9), 533 – 547. https://doi. org/10.1177/0145482X1110500905.

Zhou, L., Ajuwon, P. M., Smith, D. W., Griffin-Shirley, N., Parker, A. T., & Okungu, P. (2012). Assistive Technology Competencies for Teachers of Students with Visual Impairments: A National Study. *Journal of Visual Impairment & Blindness, 106*(10), 656 665. https://doi. org/10.1177/0145482x1210601010.

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