PLOVDIV UNIVERCITY „PAISII HILENDARSKI “

FACULTY OF PEDAGOGY

DEPARTMENT OF PEDAGOGY AND EDUCATIONAL MANAGEMENT

Bulgaria 4003 Plovdiv, 236 Bulgaria Blvd.; tel.: +359 32 261 701

Dean: +359 32 261 702, fax: +359 32 261 701, e-mail: pf@uni-plovdiv.bg

---

Krasimira Stoilova Ivanova

PERSONALIZED LEARNING - A PREDICTOR OF THE INCLUSION OF STUDENTS WITH SPECIAL EDUCATIONAL NEEDS

THESIS SUMMARY

of a dissertation work

for the award of the educational and scientific degree "PhD"

Field of higher education: 1. Pedagogical Sciences

Professional field 1.2. Pedagogy,

Doctoral program "Special Pedagogy"

Scientific Supervisor

Prof. Zhana Atanasova PhD

PLOVDIV, 2026

The dissertation work was discussed and directed for defence at a meeting of the Department of Pedagogy and Educational Management at the Faculty of Pedagogy of Plovdiv University „Paisii Hilendarski “, held on 07.04.2026.

The dissertation is structured in an introduction, four chapters, conclusions, conclusion, contributions, used literature, publications on the topic and 2 appendices. The total volume is 280 pages, of which 244 pages are main text. 17 tables and 77 figures are included. The list of used literary sources is 263, of which 19 titles in Cyrillic and 234 titles in Latin, as well as 44 regulatory acts from Internet sources. The list of author's publications consists of 5 titles.

The materials for the defence are available in the Department of Academic Staff Development and Doctoral Studies at Plovdiv University „Paisii Hilendarski “and in the Central Library of Plovdiv University „Paisii Hilendarski “.

The defense of the dissertation will take place on 03.07.2026 at 11.00 a.m. at the Faculty of Pedagogy of the Paisii Hilendarski University, Plovdiv, 236 Bulgaria Blvd., at a meeting of the Scientific Jury composed of:

Prof. Katerina Karadjova, PhD

Assoc. Prof. Gencho Valchev, PhD

Assoc. Prof. Kaloyan Damyanov, PhD

Assoc. Prof. Vanya Sivakova, PhD

Assoc. Prof. Ivan Trichkov, PhD

Author: Krasimira Stoilova Ivanova

Title: Personalized learning - a predictor of the inclusion of students with special educational needs

I express my gratitude to my scientific supervisor Prof. Zhana Atanasova, PhD for her expert guidance, the opportunity she gave me and the trust she placed in me!

I also thank the lecturers from the Department of Pedagogy and Educational Management and the lecturers from the Faculty of Pedagogy for their training during my doctoral studies - for their constructive criticism and uncompromising opinion!

INTRODUCTION

In modern educational policy, inclusion through inclusive education has established itself as a leading paradigm focused on the practice of equal access, quality education and equal participation in the educational process of all students, including students with SEN, according to their individual abilities.

Students with SEN are a diverse group, characterized by different individual characteristics that require targeted pedagogical support. In this aspect, personalized learning as an innovative approach is a predictor of their full inclusion in school education.

Personalized learning is not a new concept, but with the widespread digitalization of education, it is gaining new dimensions of application to all students, and especially to children and students with SEN. Inclusive education is transforming both traditional models of removing barriers to education for every child and every student through the implementation of universal learning design and innovative teaching methods, and the application of inclusive processes in a model of digital inclusive education.

The relevance of the researched issues is aimed at the theoretical understanding of personalized learning in the context of the inclusion of students with SEN with a focus on pedagogical practice and implementation in educational institutions.

An important predictor of inclusion through inclusive education for students with SEN is personalized learning. Academic perception, reflective models, trust and confidence of the school and family context are of essential importance for the effective implementation of personalized learning with students with SEN. Personalized learning is not only a pedagogical strategy, but also a value paradigm that affirms the uniqueness of children and students with SEN and creates conditions for their full participation in the inclusive environment of school education. At the same time, personalized learning is not a panacea for realizing the process of inclusion through inclusive education. It is important to know and understand inclusive philosophies, inclusive policies, and good inclusive practices.

The considered problem of personalized education of students with SEN is relevant and significant for their full inclusion in the educational process, thus outlining the expected contributions in the theoretical and applied aspect of the present study.

CHAPTER ONE

1.0. THEORETICAL ANALYSIS OF THE PROBLEM

1.1. THE CONCEPT OF INCLUSION THROUGH INCLUSIVE EDUCATION

The concept of inclusion through inclusive education interprets the definition and concept of inclusive education; inclusive education as a philosophy, as a human right, as a process, as a perspective and a future.

The evolution of the concept of inclusion through inclusive education; approaches to inclusive education; the synergy between inclusive education and inclusion; inclusive education in Bulgaria; the goals of inclusive education are examined and interpreted. Special focus is placed on the dimensions of inclusive education in several models, emphasizing **the conceptualization of inclusive education in a broad and narrow sense**. The first model of the dimensions of inclusive education includes a **dominant dimension** and a **multi-oriented dimension** of inclusive education as a product of multiple values and processes. As a second dimensional model, inclusive education was analysed in **horizontal and vertical dimensions**. A third model of dimensions of inclusive education is specified as **school culture, educational policy, practical inclusion**. The principles of inclusive education and digital inclusive education are interpreted.

CHAPTER TWO
2. PERSONALIZED LEARNING

The second chapter provides an analysis of the concept of personalized learning, tracing the evolution, definition, components, and characteristics of personalized learning. ***The general concept of personalized learning outlines it as a student-cantered learning approach.***

Interpretations of the relationship between personalized learning and neuropedagogy are embedded in the contexts of universal **design for learning; universal design; design thinking,** etc.

Models of personalized learning, as well as its spaces for the inclusion of students with SEN, were examined and analysed: **personalized learning paths; student empowerment; application of digital technologies for personalizing learning; personalized design for the learning process; personalized student assessment** including formal and formative authentic assessment with marking of student progress.

The personal learning profile, the personal learning network, and the personal learning environment are interpreted as inclusive components of personalized learning for students with SEN, with an emphasis on comparing personalized, individual, differentiated, and adaptive learning.

A comprehensive analysis of personalized learning as a factor for the inclusion of students with SEN with and without digital technologies has been conducted. The implementation of digital technologies supports personalized learning, **but it should not be overlooked that the availability, preference, and use of digital technologies and digital resources in themselves is not education but only provides conditions for it.** Personalized learning realizes inclusive education because it provides access and accessibility for all learners. Barriers to personalized learning have been identified in five dimensions: conceptual barriers, institutional barriers, psychological barriers, technological barriers, and pedagogical barriers.

Strategies for personalized learning as a factor of inclusion are conceptualized through the prism of educational profiles for students with SEN.

CHAPTER THREE
3.0. EMPIRICAL RESEARCH DESIGN
3.1. RESEARCH SETTING

The composition of the study is based on constructs for personalized learning, taking into account the academic perception, reflection and digitalization of personalized learning, its specificity and its role in the inclusion of students with SEN. The focus of the study sheds light on the determining role of personalized learning as a reliable factor with high prospective value for the effective inclusion of students with SEN in the educational environment.

The **research problem** is related to deriving answers to current problems of personalized learning as a factor for the inclusion of students with SEN, articulating conclusions, outlining guidelines and recommendations for the application of the innovative model of personalized learning, related to:

- contradictory current perception of personalized learning;
- unsystematic reflection on personalized learning as a factor for the inclusion of students with SEN;
- amorphous model of personalized learning in a digital environment at the time of the study.

The research problems posed provide orientation towards the object and subject of scientific research.

3.1.1. Object and subject of the study

The **object** of the study is to specify the essence and characteristics of personalized learning in the process of inclusive education for students with SEN.

The **subject** of the study is the individual components of personalized learning, which are predictors for the implementation of inclusive education for students with SEN.

3.1.2. Aim, objectives and hypotheses of the study

The aim of the study is to study the main characteristics, including basic and additional components of personalized learning, which are a significant factor in the inclusion of students with SEN in the educational process.

Research objectives

The set aim provides grounds for formulating the following research objectives:

1. To study the literary sources in the national, European and global scientific space on the issues related to personalized learning and inclusive education.
2. To conduct a theoretical analysis of the interaction between inclusive education and personalized learning.
3. To develop and implement a diagnostic toolkit for empirical research:

✓ defining and using the "mind mapping" method as a diagnostic tool for the perception of personalized learning by practicing teachers and pedagogical specialists;

✓ survey on the reflection of personalized learning as a factor for inclusive education;

✓ scale for personalized learning in a digital environment for students with SEN;

✓ selection and testing of smart digital technology /Artificial Intelligence Application/ in the education of students with SEN.

4. To implement an empirical study on the perception and reflection of personalized learning according to individual components of personalized learning that influence the implementation of inclusion of students with SEN.
5. To analyse the data from the empirical study on personalized learning as a factor for achieving inclusion of students with SEN.
6. To analyse the application of smart digital technology for students with SEN to implement personalized learning as an inclusive educational practice.
7. To draw conclusions, conclusions and recommendations.

Research Hypotheses

The set goal and the resulting research tasks allow the following hypotheses to be formulated:

Hypothesis 1. It is assumed that teachers' reflection on personalized learning leads to fluctuations in reflective control over the objectification of subjective pedagogical experience regarding its application in an educational environment.

Hypothesis 2. It is assumed that future and current teachers have a comprehensive and positive academic perception of the implementation of personalized learning as a new educational approach and a new educational phenomenon

Hypothesis 3. It is assumed that to implement personalized learning as a factor of inclusive education, it is necessary to take into account the strengths and potential of students in conditions of widespread digitalization of education.

Null hypothesis-0: Personalized learning is not a factor in implementing inclusive education and does not formulate requirements for additional concepts.

The hypotheses were provoked through a survey, a scale, the diagnostic tool "mind maps", testing of an Artificial Intelligence application with built-in models for personalization and creation of the inclusive educational environment.

3.1.3. Methods of scientific research:

The formulated goal, tasks and hypotheses of the study determine the choice of the following methods:

Methods of theoretical analysis:

- research of sources from the scientific literature related to inclusive education and personalized learning as a factor for inclusive education of students with SEN;
- deriving an analysis of the theoretical framework for personalized learning as inclusive education of students with SEN.

Methods of empirical research:

- surveying with a developed author's survey and author's scale, the content of which is formulated through the prism of the research questions posed;
- conducting a study using the diagnostic tool "mind maps" with the central concept of "personalized learning";
- educational experiment using a mobile application with artificial intelligence.

Statistical methods

The processing of empirical data was carried out with IBM SPSS 22, STATISTICA 13 and EXCEL 2016, based on which a qualitative analysis of the results of the research was carried out.

3.1.4. Methodology and procedures of the empirical study

The theoretical-empirical research of the dissertation is longitudinal. It was conducted over a period of three years: November 2022 - October 2025. The experiment conducted in the period October 2024 - October 2025 is educational.

The theoretical-empirical research goes through the following stages:

- planning and creating a comprehensive organization of the theoretical-empirical research;
- research of the scientific literature on historical and contemporary scientific concepts and paradigms of inclusive education and of personalized learning as a factor for implementing inclusive education for students with SEN;
- compositional layout of the research architecture: topic, statement of the research problem, object, subject, goal, tasks, hypotheses.
- conducting observations on the awareness of teachers and pedagogical specialists about inclusive education and personalized learning.
- developing and structuring an author's concept and scope of the research;
- creating a holistic organization of the theoretical-empirical research;
- development of an author's scale aimed at parents and teachers.
- selection, definition and conduct of research with the diagnostic tool "mind maps";
- conducting a training experiment with an application of artificial intelligence as a smart digital technology with students with SEN in a hybrid learning model;
- a scale for evaluating the results of the experiment;
- analysing the results of empirical studies;
- formulating conclusions and a conclusion.

The first applied diagnostic tool is an author's multidimensional survey and aims to establish the reflection on personalized learning by active teachers and pedagogical specialists.

Procedure: the participants in the study /active teachers/ are provided with a survey of 28 questions, which should be answered with "yes" or "no". The survey is composed of two parts.

The first part is aimed at shaping the demographic profile of the respondents: age, education, location.

The second part presents the 28 questions with a possible answer choice of "yes" or "no". The survey includes carefully selected questions related to the purpose of the scientific research. *The first group* of questions 1, 2, 4, 6 are aimed at reflecting on the holistic concept of "personalized learning". *The second group* of questions 5, 7, 25 are aimed at the inclusion of students with SEN in the process of personalized learning. *The third group* of questions 9, 10, 11, 12 are aimed at reflection on aspects of personalized learning. *The fourth group* of questions 3, 7, 8, 13, 18 are aimed at the organizational school culture regarding personalized learning. *The fifth group* of questions 20, 21, 24, 26 concern the normative and organizational regulation of inclusive education as a basis for implementing personalized learning. *The sixth group* of questions 19, 22, 23, 27 are aimed at including innovative models in education in the process of personalized learning. *The seventh group* of questions 14, 15, 16, 17 are aimed at the continuing qualification of teachers in the direction of "personalized learning". The last item 28 is not included in the grouping but is set to weigh social desirability and social approval when filling out the survey.

Participants in the study: Participants in the study are 43 active teachers and pedagogical specialists from the country.

The second diagnostic tool applied is the diagnostic tool “mind map.” The mind map aims to establish the perception of personalized learning and is applied after the respondents have acquired knowledge about personalized learning.

Procedure: The participants in the study are provided with information in advance about the theoretical foundations of personalized learning. The participants form teams in which they develop a mind map with the central concept of "personalized learning".

Participants in the study. Participants in the empirical study are 85 students from the Master's Degree Program, who study and work as teachers, i.e. they are in a dichotomous role.

The third applied tool of the empirical study is a training experiment conducted with the DuoLingo mobile application as a smart-digital technology, with students with SEN.

Participants in the study: 7 students with SEN, aged 11 to 16 years, with SEN in mathematics: with a level of mathematical knowledge: addition and subtraction up to 10 and/or a level of mathematical knowledge: mastery of the multiplication table.

The fourth diagnostic tool is a scale for evaluating the conducted educational experiment with an artificial intelligence application as a smart digital technology with students with SEN in a hybrid learning model.

Procedure: Respondents are provided with a 30-item author's scale with a seven-point Likert scale with items in 3 groups. *The first group* of items from the 1st to the 10th item is related to the digital competencies of students with SEN and to the attitudes towards the use of smart digital technologies by students with SEN. *The second group* of items from the 11th to the 20th item is related to assessing the engagement of students with SEN in solving mathematical problems through the digital application. *The third group* of items from the 21st to the 30th item is related to assessing the progress of students with SEN.

Participants in the study: A total of 34 participants in the study were divided into three groups: 5 parents of the students with whom the educational experiment was conducted; 4

pedagogical specialists and 25 teachers who teach students with SEN. Two of the parents of the students who took part in the experiment did not complete the scale.

CHAPTER FOUR
4.0. RESULTS ANALYSIS
4.1. REFLECTION ON PERSONALIZED LEARNING

Reflection on personalized learning is an important factor in the implementation of personalized learning. When a teacher develops his reflective abilities, he not only knows the educational profiles of his students, but also manages to demonstrate dynamism and flexibility in every learning situation, to create a positive educational environment and to motivate students for higher and even higher school achievements according to the strengths and potential of students with SEN.

The descriptive statistics of the personalized learning scale are presented in Fig. 1. and Table 1.

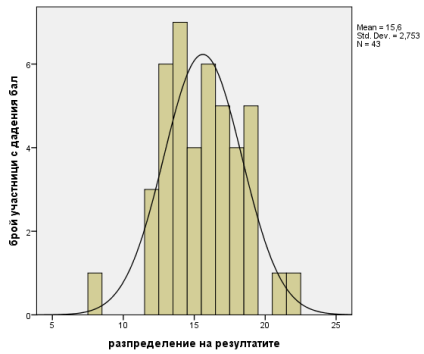


Fig. 1. Histogram of the distribution of the raw score from the scale

Table 1. Descriptive statistics

Total number of participants	Minimal	Maximum	median	average score (standard error)	standard deviation	quartiles	asymmetry	excess
43	8	22	16	15,6 (0,42)	2,76	14, 16,18	-0,039	0,365

When testing the hypothesis of normality of the distribution of the total raw score on the personalized learning scale, there is no reason to reject the hypothesis of the distribution according to the Shapiro-Wilk criterion (stat.=0.972; sig.=0.371>0.05) i.e. the distribution of the total raw score on the entire personalized learning scale is normal. As can be seen in Fig. 1, the histogram is symmetric.

Cronbach's Alpha (0.6) for all items shows that the scale has good reliability. The questionnaire can be applied in practice. **For Cronbach's Alpha, if the corresponding item is removed**, no item is noticed that would make an exception and affect the overall Cronbach's Alpha. It is not necessary to remove items because the reliability will not increase, and will even decrease if someone is removed.

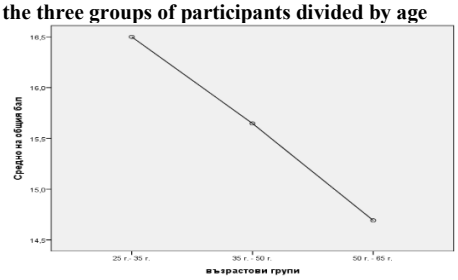
When testing hypotheses about the influence of factors on the score on the personalized learning scale, the influence of the factors: age, education, and location on the raw score on the personalized learning scale was tested. A hypothesis test was performed on the equality of the results on the scale for participants of different ages from three age groups: 22-35, 35-50, and 50-65 years. The results show that there is no significant statistical difference between the results shown by the three age groups (sig.=0.273>0.05). The difference is small and insignificant. This means that respondents of different ages show similar results on the scale. Table 3. presents the group statistics of the three age groups. Fig. 2 presents a comparison between the mean values of the groups. The difference is small and insignificant. This means that respondents of different ages show similar results on the scale. Table 2. presents the group statistics of the three age groups. Fig. 2 presents a comparison between the mean values of the groups.

.

Table 2. Group statistics

age	number	average	standard deviation	Standard error of the mean
22-35	12	16,50	3,060	,883
35-50	17	15,65	2,597	,630
0-65	14	14,69	2,689	,746
total	43	15,60	2,785	,430

Fig. 2. Diagram comparing the average values on the scale for the three groups of participants divided by age



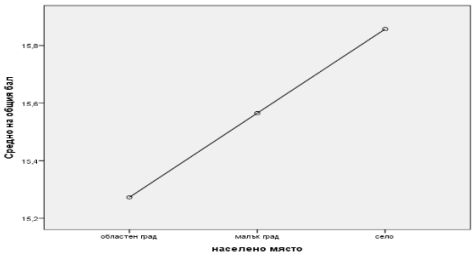
A hypothesis test was made for the equality of the results of the scale for the participants **from different settlements** in three groups: from a regional city, from a small town and from a village. The results show that there is no significant statistical difference between the results shown by the participants from different settlements (sig.=0.9>0.05). The difference is small and insignificant, which indicates that the respondents from the three groups give similar answers on the scale. Table 4. presents the group statistics of the three groups. Fig. 3 presents a comparison between the mean values of the groups.

.

Table 3. Group statistics

Place of residence	number	average	standard deviation	Standard error of the mean
regional town	11	15,27	3,580	1,079
Small town	23	15,57	2,643	,551
village	8	15,86	2,193	,829
general	43	15,60	2,785	,430

Fig. 3. Diagram for comparing average values on the scale by settlement

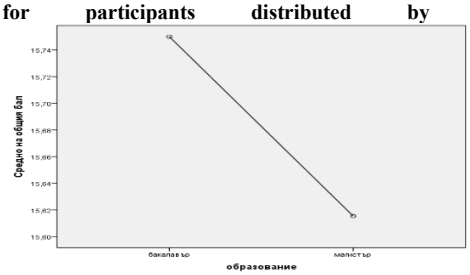


A hypothesis test was made for the equality of the results of the scale for participants with **different education levels** in two groups: with a bachelor's and a master's degree. The results show that there is no significant statistical difference between the results shown by participants with different levels of education (sig.=0.8>0.05). The difference is small and insignificant, which means that the level of education does not affect the results on the scale. Table 4. shows the group statistics of the three groups. Fig. 4 shows a comparison between the mean values of the groups.

Table 4. Group statistics

education	number	average	Standard deviation	Standard error of the mean
bachelor	17	15,75	2,417	,698
master	26	15,62	2,669	,524
general	43	15,66	2,560	,415

Fig. 4. Diagram for comparing the average values on the scale for participants distributed by education



Results and discussion on individual items

The results and discussion on individual items from the survey of respondents are presented in separate Figures containing Diagrams with the obtained results. The respondents

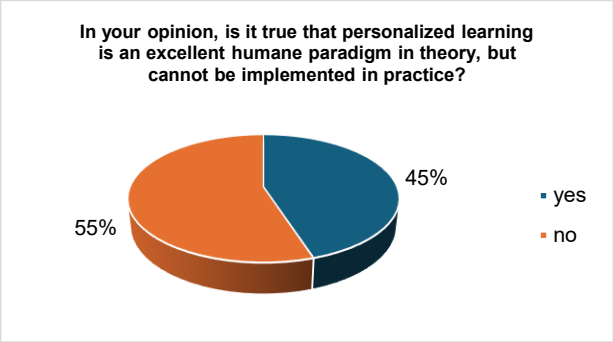


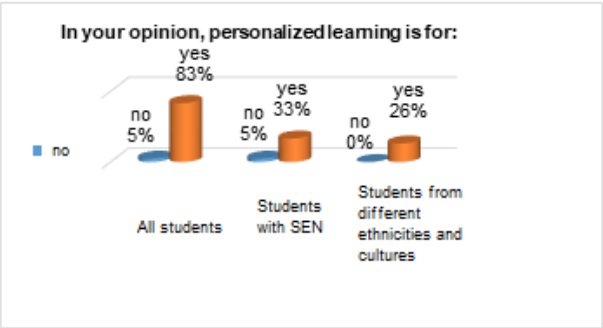
Fig. 5. Personalized learning as a humane paradigm.

answered the question almost dichotomously. The hesitation related to the answers that personalized learning cannot be implemented in practice is strange because every teacher knows the problems and strengths of their students, knows their learning styles and actually implements elements of personalized learning.

Explanatory aspects are also related to the very innovativeness of personalized learning. Every novelty encounters stereotypes and at the beginning there is resistance to it such as institutional barriers; lack of resources; permissible technological inequality; unpreparedness and initial resistance of teachers to the innovation of "personalized learning".

The results shown in Fig. 6 reflect the existing theoretical and practical dimensions of inclusive education: narrow dimension, broad dimension and complex dimension.

Fig. 6. Dimensions of inclusive education



The results for the possibilities for implementing personalized learning in the educational institution, shown in Fig. 6, are extremely positive, which are somewhat contradictory to the results in Fig. 5.

The intellectual and praxeological reflection shown can be summarized as an approval of personalized learning, but also as concerns about dealing with the existing barriers. It is evident that the intellectual reflection presents a critical intentionality, i.e. despite the knowledge and pedagogical experience, the reflective self does not have enough confidence to implement personalized learning.

Fig. 7.

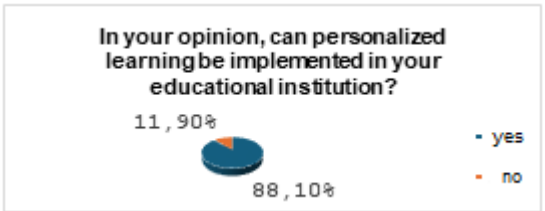
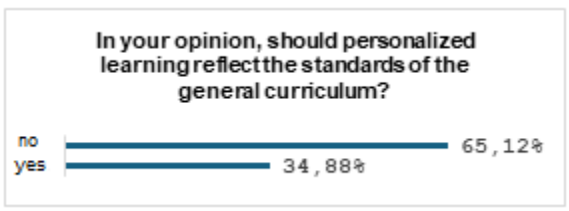


Fig. 8.



Personalized learning is not perceived as a self-paced performance in the classroom but is related to common requirements for all students or compliance with the standards of the general curriculum. The results for the structuring of personalized learning with an emphasis on the resource teacher are surprising. The most common dimension - the narrow dimension of inclusive education (inclusive education is for students with SEN) makes a transfer to

personalized learning visible from the results in Fig. 9. However, it is obvious that reflection has been triggered towards familiar models of performance.

Fig. 9.

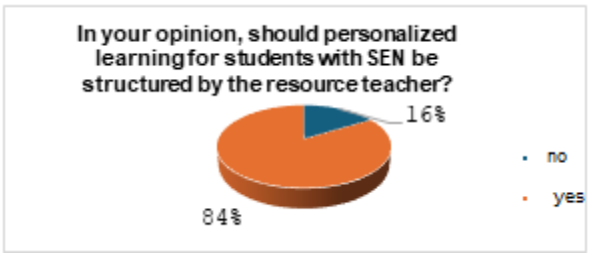
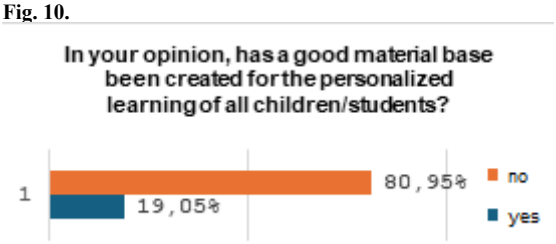


Fig. 10.



Respondents who know the components of personalized learning from a material base perspective and have used it demonstrate technological or praxeological reflection training /Fig. 10./. Respondents who had to solve technological problems and make technological decisions in a reflexive plan demonstrate an already forming structured praxeological reflection.

In Fig. 11. the results related to the knowledge of the diversity of students as children/students with different abilities are presented.

Fig. 11.

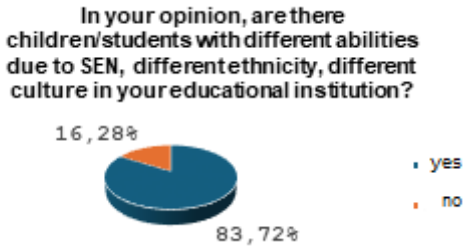
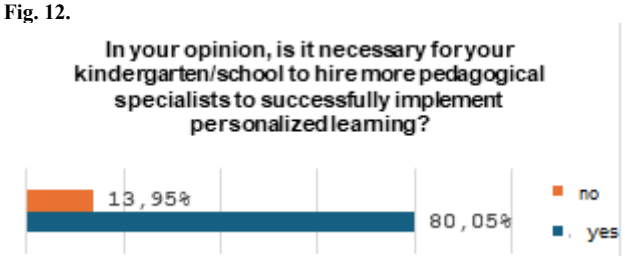


Fig. 12.



In Fig. 12. there is a visible reflection and conscious projection of the need for new pedagogical specialists, for whom a profession has probably not yet been created. The reflection of the respondents is related to the representation of basic aspects of their professional commitment, which lead to the specialization of activities for the implementation of personalized learning.

The respondents' prognostic attitudes regarding parental attitudes are reflected in Fig. 13. and Fig. 14. Praxiological reflection includes self-evaluation elements and is related to the analysis of one's own practice. Respondents exhibit praxiological reflection that reflects their professional practice of social acceptance of students with diverse abilities.

Fig. 13.

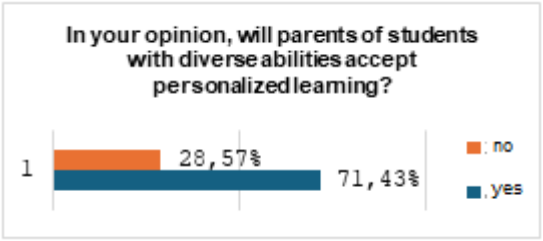
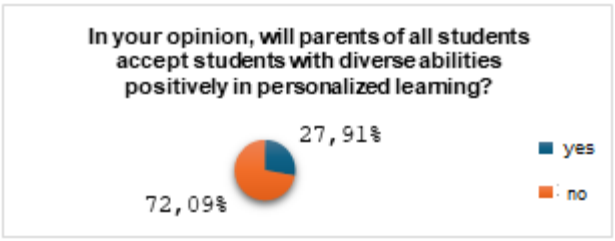


Fig. 14.



The result related to the reflection of the respondents, related to the attitudes of the students towards the social and personal acceptance of students with diverse abilities when implementing personalized learning, is extremely significant because it leads to the implementation of inclusive education through personalized learning. A positive fact is the result obtained in Fig. 15, which provides a favourable perspective for the inclusion of students with diverse abilities, including students with SEN.

Fig. 15.

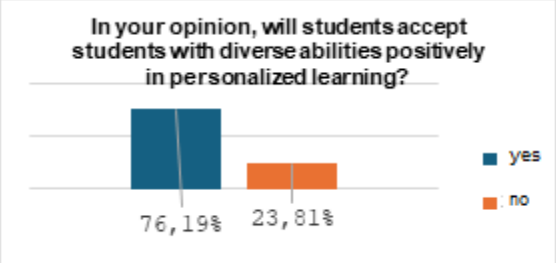
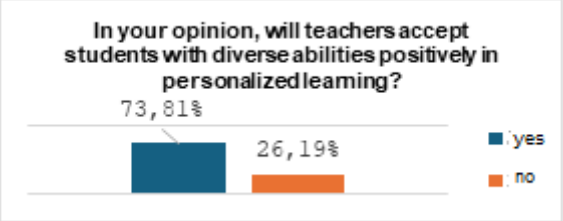


Fig. 16.



Lower values appear in the reflection on inclusion for teachers /Fig. 16. / compared to the values related to reflection on inclusion of students with diverse abilities /Fig. 15./. The praxeological reflection of the respondents has led to the inability to solve some professional and/or life problems related to students with SEN. The demonstrated reflection of the respondents is related to social insight, in which important elements are categorization and "labelling", and the acting teachers handle labels related to SEN. There are possible concerns about the new challenges and responsibilities of personalized learning.

Fig. 17.

Fig. 17. presents cooperative reflection and the results are significant for the implementation of personalized learning, because dialogic reflection is closely related to prosocial behaviour.

Reflection and school culture are related to improving the qualifications of teachers and pedagogical specialists.

Fig. 18.

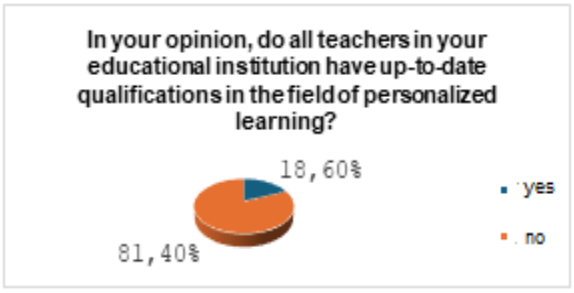


Fig. 19.

Respondents provide reflection on their qualifications /Fig. 18./. The reflective responses /dichotomously presented in Fig. 19. / about the insufficient competence of many of the trainers in different qualification forms can be interpreted in the space of social desirability. A praxeological reflection is observed, which transfers the reflection from all trainings conducted to trainings for personalized training. The reflective competence of the respondents integrates, rather than interprets, into a correct answer.

The reflection of respondents on personalized learning in relation to the focus groups on inclusive education /Fig. 20. / and as promoting inclusive processes /Fig. 21. / is defined as positive.

Fig. 20.

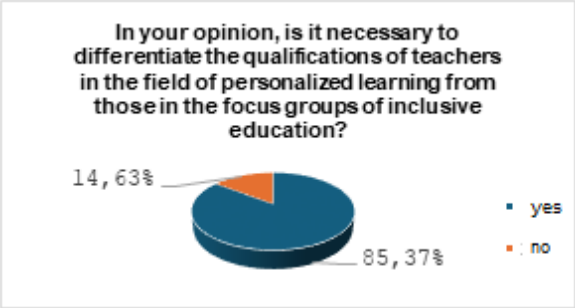
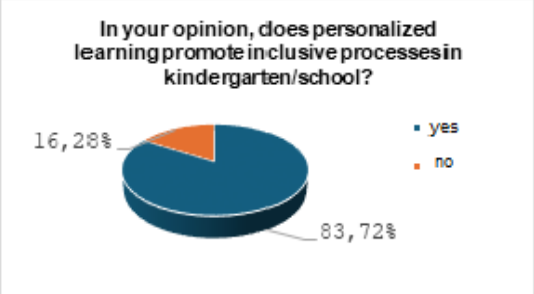


Fig. 21.



The question of the relationship between personalized learning and digital technologies /Fig. 22. / and the digitalization of education /Fig. 23/ inevitably arises.

For personalized learning, it is important that the focus of education be on the student, that there is consideration for his or her needs, strengths, and potential.

Fig. 22.

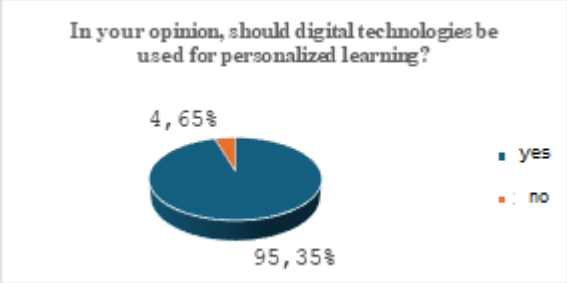
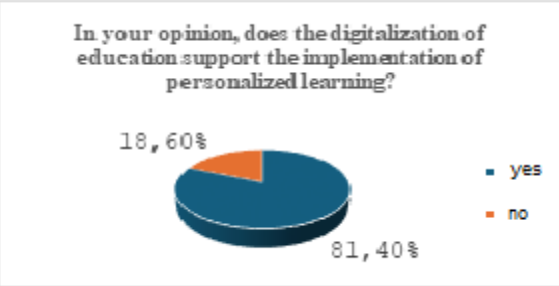


Fig. 23.



Personalized learning requires provision of resources. The results in Fig.24. and in Fig.25. raise pressing questions about financing in inclusive education for students with SEN, which may affect the implementation of personalized learning. A shared opinion among respondents regarding the determination of the teaching workload of the resource teacher and financing for students with SEN stands out.

Fig. 24.

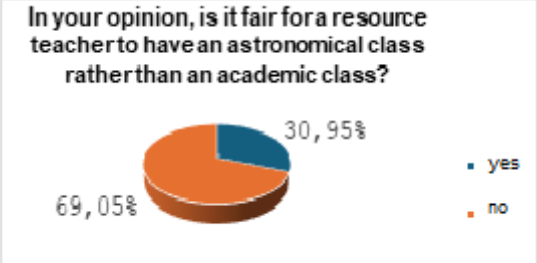
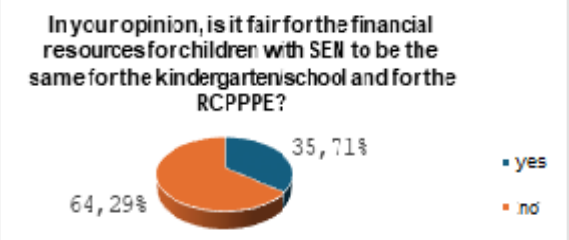
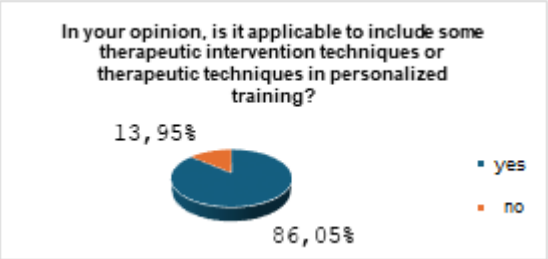


Fig. 25.



The resource teacher is engaged in astronomical hours of teaching employment and there is often a very fragmented schedule of the resource teacher in the school. In the case of funding, when the EPR is in the school itself and the funding is in the school, the costs are much higher for students with SEN than when a resource teacher from the RCPPPE works with the student with SEN.

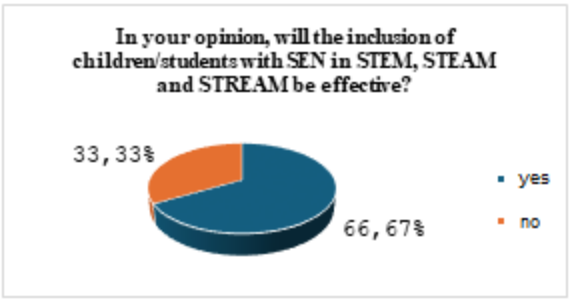
Fig. 26.



Personalized learning is **not bound to or includes therapies**, but some therapeutic techniques may be used. Personalized learning creates an environment that can **support therapeutic goals** for students with SEN but does not replace them.

As can be seen from the results in Fig. 26, the reflection on personalized learning starts with some stereotypes, the acceptance of personalized learning only for students with SEN or the narrow understanding of inclusive education.

Fig. 27.



The interpretation in this direction meets resistance in the results in Fig. 27. Respondents note the importance of STEM, STEAM and STREAM for increasing the effectiveness of the educational process for students with SEN.

Digital technologies with their capabilities for multi-sensory, realistic three-dimensional presentation of learning content, with opportunities for learning by doing, and with the support of positive emotional learning experiences create opportunities for compliance with the Universal Design for Learning Framework, which is effective for all students.

Fig. 28. and Fig. 29. present the results for removing the student with SEN from the class during important events for the class and for punishments. Reflection with a result of 19.05% agreement regarding students with SEN from the class can also occur in cases where the class teacher cannot cope with the unacceptable behavioural manifestations of the student with SEN in the regular class or when conducting personalized education.

Fig. 28.

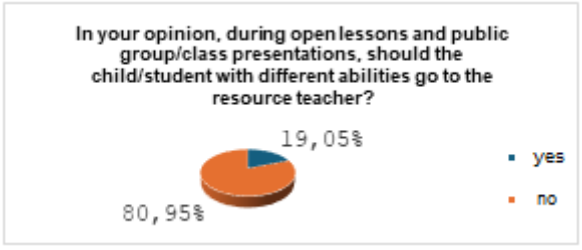
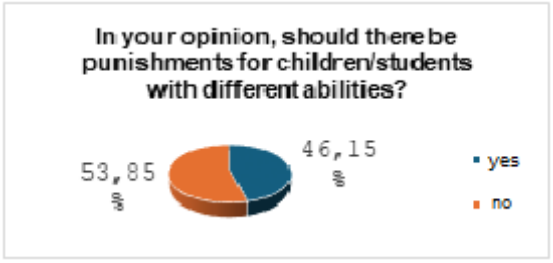


Fig. 29.



Students with SEN are not punished in standard ways, but receive support, understanding and educational measures tailored to their individual needs.

Fig. 30. presents the results for adapting the curriculum. The worrying fact that 32.56% of respondents give an affirmative answer speaks of a reflection related to the usefulness and effectiveness of adapting the curriculum in certain cases for all students, or a reflection related to the lack of knowledge of the specifics of adapting the curriculum. The reflection of the respondents on adapting the curriculum is likely to be transferred to personalized learning in anti-inclusive learning models.

Fig. 30.

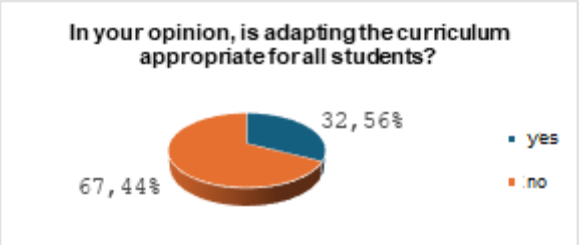
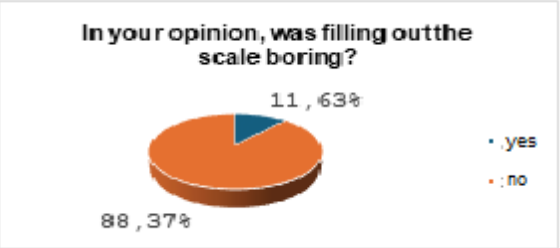


Fig. 31.



.

The results from Fig. 31. show a desire for social approval, a lack of acceptance of innovations, and a lack of pedagogical reflection on the problems posed by personalized learning.

4.2. ANALYSIS OF THE RESULTS FOR ACADEMIC PERCEPTION OF PERSONALIZED LEARNING

Academic perception can be defined as the subjective intellectual perception and assessment of personalized learning. Academic perception is not a simple perception of information; it also includes evaluation. Its implementation is influenced by previous pedagogical experience and reflection on one's own pedagogical achievements, pedagogical stereotypes towards pedagogical routine and towards pedagogical innovations, and subjective educational and career goals and motivation in the educational context.

The development of mind maps by individual teams provided an opportunity for brainstorming and discussions about personalized learning. 17 mind maps were developed in teams of 85 study participants and are presented in different valences: 4 mind maps are from the first to the fourth valence; 5 mind maps are from the first to the third valence, 7 mind maps are from the first and second valence, 1 mind map is only from the first valence.

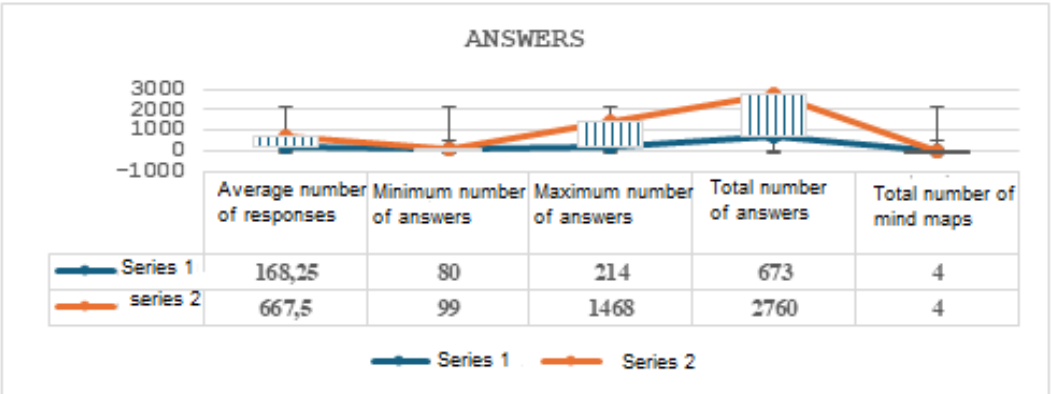
The number of statements and expressions received from the respondents in the different valences is presented in Table 5.

Number of concepts of first valence	Number of concepts of second valency	Number of concepts of third valency	Number of concepts of fourth valency
214	202	177	80
31,80%	30,01%	26,30%	11,88%

Table 5. Number of statements and expressions from the mind maps

The total number of concepts and short phrases is 673 and for the purpose of interpreting the results, they are summarized in groups and series. The summarized responses are analyzed through Series 1, which presents the responses in the individual valence, and Series 2 presents the responses in relation to the total number of responses.

Fig. 32.

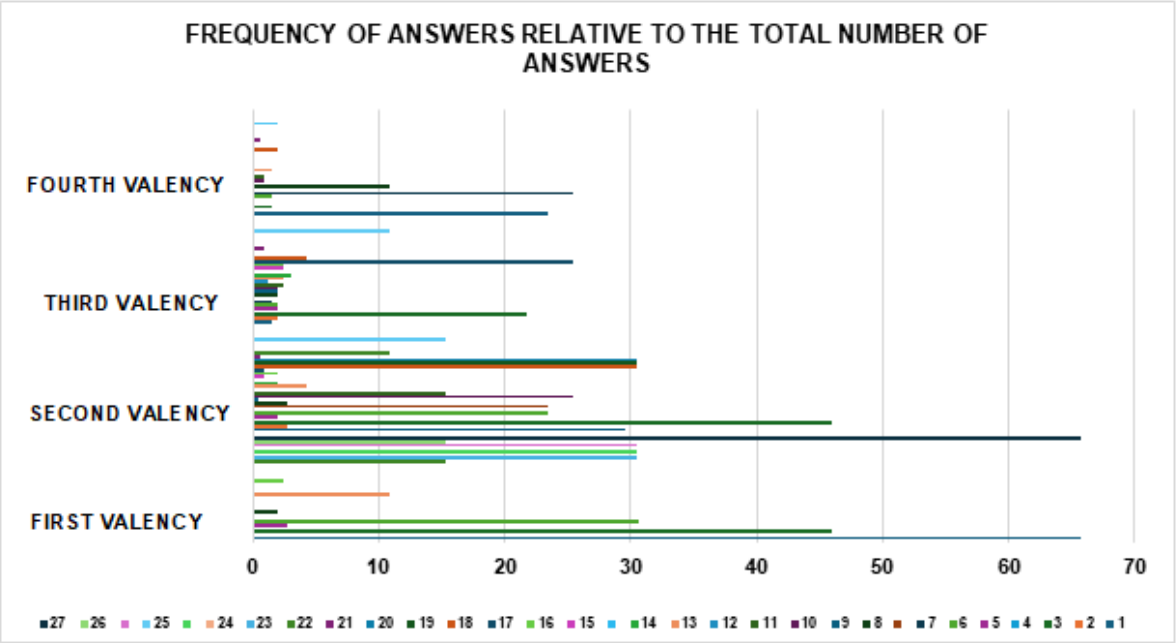


The concepts used, which have the highest frequency of presentation in the individual valences of the mind maps, are presented in a summarized model in Table 6. The total percentage of the concepts and expressions used exceeds 100% because more than one response was entered in the different valences of the mind maps. The frequency distribution of the results obtained relative to the total number of responses is presented in Fig. 33.

Table 6.

	first valency	second valency	third valency	forth valency
1. strengths, needs, interests of the student	65,82	29,60	1,48	23,48
2. e-learning, m-learning, u-learning, s-learning	0,15	2,67	1,93	0,15
3. working with the whole class	45,91	45,91	21,69	1,48
4. Challenge of modern education systems	0,15	0,15	0,15	
5. personal intelligent environment	2,67	1,93	1,93	0,15
6. students learn best	30,61	23,48	1,93	1,48
7. students should be co-designers of the curriculum and the learning environment		23,48	1,48	25,41
8. flexible ubiquitous learning	1,93	2,67	1,93	10,85
9. quality teachers		0,44	1,93	
10. competency-based model	0,15	25,41	1,93	0,89
11. use of digital technologies and electronic resources		15,30	2,37	0,89
12. learning by doing		0,15	1,19	0,15
13. commitment and responsibility towards one's own learning	10,85	4,31	2,37	1,48
14. effective for students with special educational needs		1,93	3,12	0,15
15. effective for gifted students		0,89	2,37	0,15
16. right and freedom of choice for the student	2,37	1,93	2,37	0,15
17. general and additional support		0,89	25,40	
18. overcoming norms and stereotypes		30,46	4,31	1,93
19. flipped teaching		30,46		
20. co-teaching		30,46		
21. creates communities	0,15	0,59	0,89	0,59
22. providing opportunities for each student to learn at their own pace and speed	15,30	10,85		
23. positive emotional environment	30,46			
24. cognitive, emotional and social engagement of each student	30,46			
25. different educational trajectories for each student	30,46	15,30	10,85	1,93
26. roles of the teacher: motivator, inspirer, facilitator, partner, etc.	15,30			
27. new educational approach	65,82			0,15

Fig. 33.



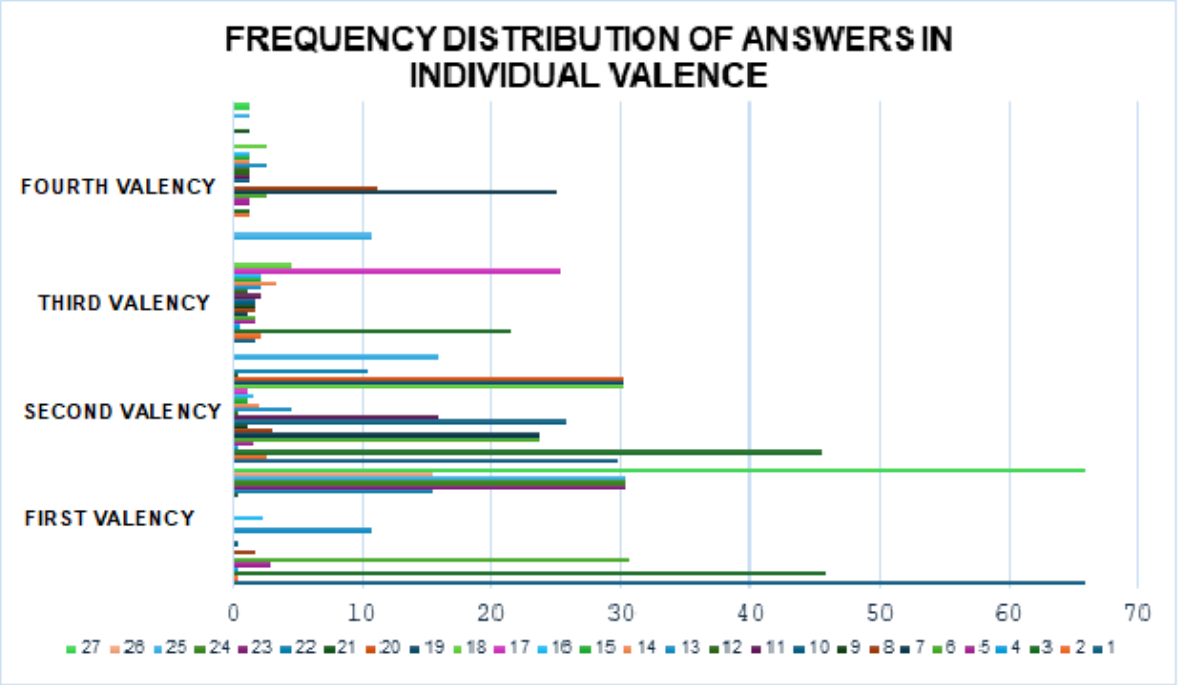
The relative share of concepts in each valence is calculated by comparing the number of concepts or expressions in the corresponding valence. Table 7 presents results for concepts and short expressions located in the individual valences with different frequencies and weights of use. Fig. 34 presents the frequency distribution of concepts in each individual valence.

Table 7.

	first valency	second valency	third valency	forth valency
1. strengths, needs, interests of the student	65,89	29,7	1,69	23.75
2. e-learning, m-learning, u-learning, s-learning	0,47	2,48	2,25	1,25
3. working with the whole class	45,79	45,54	21,47	1,25
4. Challenge of modern education systems	0,47	0,49	0,56	
5. personal intelligent environment	2,8	1,48	1,69	1,25
6. students learn best	30,73	23,76	1,69	2,5
7. students should be co-designers of the curriculum and the learning environment		23,76	1,13	25
8. flexible ubiquitous learning	1,7	2,97	1,69	11,25
9. quality teachers		0,99	1,69	
10. competency-based model	0,47	25,74	1,69	1,25
11. use of digital technologies and electronic resources		15,84	2,26	1,25
12. learning by doing		0,49	1,13	1,25
13. commitment and responsibility towards one's own learning	10,75	4,46	2,26	2,5
14. effective for students with special educational needs		1,98	3,39	1,25
15. effective for gifted students		0,99	2,26	1,25
16. right and freedom of choice for the student	2,34	1,48	2,26	1,25
17. general and additional support		0,99	25,42	
18. overcoming norms and stereotypes		30,2	4,52	2,5
19. flipped teaching		30,2		
20. co-teaching		30,2		
21. creates communities	0,47	0,49	0.56	1,25
22. providing opportunities for each student to learn at their own pace and speed	15,42	10,4		
23. positive emotional environment	30,37			
24. cognitive, emotional and social engagement of each student	30,37			

25. different educational trajectories for each student	30,37	15,84	10,73	1,25
26. roles of the teacher: motivator, inspirer, facilitator, partner, etc.	15,42			
27. new educational approach	65,88			1,25

Fig. 34.



The results show the different weight of the individual concepts - statements both in a generalized form and in the individual valences of the mind maps. Three statements are only derived in the first valence: 23. (30.37), 24. (30.37), and 26. (15.42). Obviously, the respondents accept these characteristics as inherent in personalized learning and position them as basic. Statements 23. and 24. represent current understandings of modern education as a personalized learning environment and logically the respondents bring them up as imperatively significant for personalized learning in the context of inclusive education. Eight statements: 7, 9, 11, 12, 14, 15, 17 and 18 are not marked in the first valence. It is likely that the characteristics related to these statements are perceived by the respondents as complementary characteristics of personalized learning. At the same time, the lack of statements: 14. and 15 in the first valence is considered a positive trend. In the overall educational landscape of personalized learning, the respondents do not note the statements: 7., 9., and 17. in the first valence, as well as statements: 11., 12. For the first three statements (7., 9. and 17.) marked as missing in the first valence, it is evident that the respondents reject the active participation and commitment to designing the learning environment and the curriculum by the students; the quality of the educational process by the teachers, and general and additional support. If it is clear that the statement related to general and additional support is ignored due to its excessive exploitation in the school environment and the respondents accept it as a routine activity that is not linked to the innovative model of personalized learning, it is strange that the statements 7. and 9., which are a guarantee for the effective implementation of personalized learning, do not appear in the first valence. Probably through the prism of their own pedagogical experience and clearly outlined prospects for the implementation of personalized learning, respondents are afraid of assessing the quality of their pedagogical activity and involving students as co-designers of the

curriculum and the learning environment. The lack of statements 11. and 12. in the first valence can be explained by the ambiguities of the application of specific digital technologies and electronic resources for personalizing learning. At the same time, statement 11. appears with a relatively medium frequency (15.84) in the second valence. The alleged reference to the fact that the individual technology does not include, but the model of its use does should not be ignored. Statement 12. appears with a low frequency in the second, third and fourth valences, respectively (0.49), (1.13) and (1.25). A fact that shows that respondents do not accept this learning model as fundamental for personalized learning. Learning with digital technologies and learning by doing complement each other and in synergy create an engaging, interactive and effective educational environment. The remaining statements occur in all valences of the mind maps. The highest frequency (65.89) is noted for statements 1 and 25. Respondents accept that personalized learning is a new educational approach that is aimed at the strengths, needs and interests of students and has a focus on the strengths of students, which are the basis for building individual educational trajectories that promote personal development, motivation and success in learning or for structuring personalized learning. The frequency of statement 3., with approximately equal frequency in the first (45.79) and the second (45.54) valences, shows that the respondents have derived an academic perception and understanding of the main characteristic of personalized learning - the teacher works with the entire class regardless of the students' abilities and thus implements inclusive education for each student. The appearance of the statement in all valences, although with decreasing frequency (21.47) and (1.31), speaks of the academic perception, social and educational acceptance of its significance by the respondents. There is an academic understanding that the teacher's workload does not increase when working with the entire class, but rather the teaching and assessment style is flexibly changed, as the responsibility for learning is distributed between the teacher and the students, between individual teachers. Statement 13. appears in all valences with decreasing frequency from the first to the fourth valence, respectively (10.75), (4.46), (2.26) and (2.5). The decreasing frequency from the first to the fourth valence shows the importance that respondents attach to statement 13. and its role in personalized learning and in addressing students' lack of engagement with their learning. This analysis is in favor of the identification of innovative teaching methods through statements 19. (30.2) and 20. (30.2) in the second valence with a high frequency /compared to the frequencies shown in the study/. In the context of student engagement in learning through innovative teaching methods, statement 16. with a frequency of occurrence of the statement in the first valence (2.34), the second valence (1.48), the third valence (2.26) and the fourth valence (1.25). The occurrence of the statement in all valences shows that the respondents express an academic perception of the right and freedom of choice for students' learning as an important aspect of personalized learning.

The respondents confirmed their understanding of the development of education in accordance with the use of increasingly up-to-date digital technologies in statement 11, which appears with a frequency of (15.74) in the second valence, (2.26) in the third valence and (1.25) in the fourth valence. The appearance of the statement in the second, third and fourth valences shows the understanding and acceptance by the respondents of the growing role of the digitalization of education and its role in the personalization of learning. The use of digital technologies and electronic resources makes it possible to implement personalized learning in a context-aware learning model. In this way, the most important characteristic of personalized learning is realized: "providing opportunities for learning at each student's own pace and speed" - statement 22.

Respondents have derived this characteristic in the first (15.42) and second (10.4) valence with a high frequency of 21 academic perceptions. The uniqueness of each student cannot be supported in personal development if the teacher does not know the strengths, needs, interests and potential of each student. There is a clear and categorical knowledge of the characteristic mentioned in statement 22, both of personalized learning and of inclusive education, by the respondents, who bring it out in all valences with the highest frequencies: first (65.88), second (29.63), third (1.52) and fourth (23.72) valences. Here lies the delicate difference between individual and personalized learning.

Logically and as an inherent characteristic of personalized learning, the respondents have derived statement 5. /although with low frequency/ in the first (2.8), second (1.48), third (1.96) and fourth (1.25) valences. The presence of the statement in all valences shows that the respondents, although timidly, take into account the importance of the statement "personal intelligent environment" for the implementation of personalized learning. The results for statement 4. are interesting, which appears with frequencies: first (0.47), second (0.49) and third (0.56) valences. Apparently, the teacher respondents accept personalized learning as a weak challenge, probably estimating their own professional and digital competences, and the possibilities for mastering innovative learning models as completely sufficient to implement personalized learning.

Some confusion arises from the results of statement 8. with frequencies: first (1.7), second (2.97), third (1.69) and fourth (11.25) valences. The lack of responses in the first valence, and low frequencies in the first, second and third valences, and almost ten times higher frequency only in the fourth valence, can be deduced an explanatory model that the respondents do not accept personalized learning as flexible and ubiquitous learning. Rather, they neglect the flexibility of learning supported by its ubiquity. Personalized learning can and should be ubiquitous because it meets the contemporary needs of students, promotes motivation, and guarantees a more equitable and effective education. The response frequencies for statement 2 are not surprising. It appears with low frequencies in all valences: first (0.47), second (2.48), third (2.25) and fourth (1.25) valences. The result shows a stable understanding of the ubiquity of personalized learning, and the low frequencies reflect a rejection of ubiquity. M-learning has the highest frequency (2.48) in the second valence. S-learning is assumed to be unclear due to the multitude of smart digital technologies and the lack or insufficient use of some smart technologies in the learning process, the lack of sufficient experience in the use of smart technologies in the created STEM centers in schools.

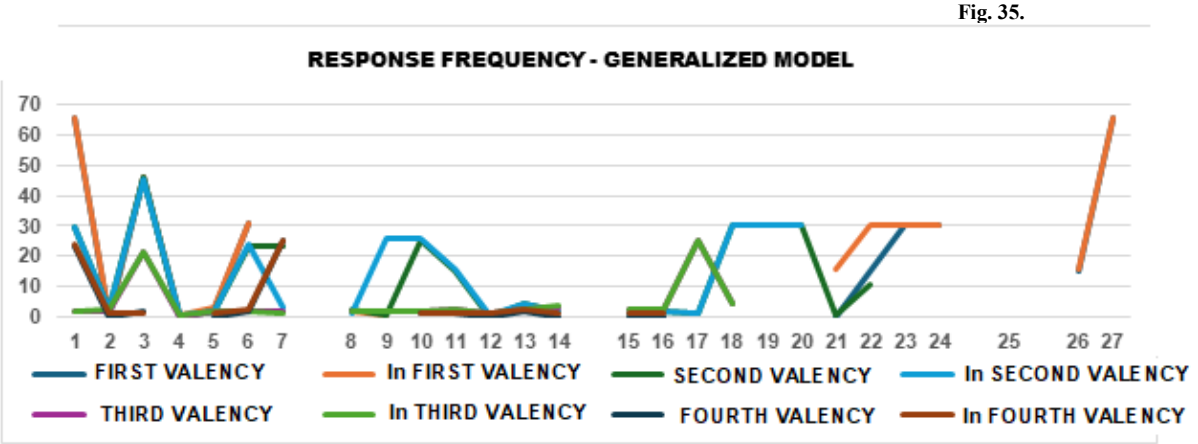
In a completely opposite pattern, the answers to statement 13 appear with frequencies: first (10.75), second (4.46), third (2.26) and fourth (2.5) valences. The results show that the respondents accept the characteristic “commitment and responsibility for their own learning” as significant through the prism of their own pedagogical experience. The decreasing frequency of the statement in the individual valences shows that the respondents present an academic perception of the meaning of the statement to facilitate the constant engagement, responsibility, confidence and even self-efficacy of students in learning. The relationship of statement 13. with statement 11., where an academic perception is also noted from the second to the fourth valence in descending order /respectively second (15.84), third (2.26) and fourth (1.25) valences/, explains that the respondents accept the role of digital technologies in increasing the engagement and responsibility for their own learning by students by creating positive emotional experiences.

The results that derive the academic perception of respondents about personalized learning in statement 27. with frequencies only in the first (65.88) and fourth (1.25) valences

show extremes in the acceptance of personalized learning as an exceptional innovation. The presence of the statement in the fourth valence with a low frequency (1.25) indicates that some respondents have the professional self-confidence, pedagogical and digital competences regarding the implementation of personalized learning in a school environment. Explanatory aspects can be sought both in terms of previous educational activities carried out by the respondents, and in terms of conviction about access, accessibility and usability to electronic platforms, digital tools and electronic resources that provide personalized learning.

Personalized learning can be implemented without technology, but the emergence and implementation of smart digital technologies, including artificial intelligence in the educational environment, allows students to receive constant, flexible and effective support for their learning. Undoubtedly, the results of the derived statement 22 are of the greatest interest, since the stylistics of the statement is one of the most common characteristics of personalized learning. The academic perception of the respondents is similar, who state the statement only in the first and second valences, with frequencies (15.42) and (10.4), respectively. The frequencies of the responses are not high, but the fact that the statement does not occur in the third and fourth valences is indicative of the academic and social perception and acceptance of the statement as a real reflection of scientific achievements, the development of smart technologies, and as a reflection of pedagogical competences and one's own pedagogical experience. Thanks to assistive, digital and smart-digital technologies, it is possible to trace personalized learning paths that construct a flexible adaptation to the educational profile, styles and pace of learning of the individual student, with personalized assessment and personalized feedback of each teacher with each student and his family environment. The analysis performed is intragroup to each individual valence, but it also reflects the overall picture. Fig. 35 presents a generalized model of the frequency distribution of responses both in general and in each individual valence.

Fig. 35.



From Fig. 33., overlapping statements provided by the respondents are clearly visible. There are differences in statements 2., 3., 5., 6., 10., 17., 21. As well as the appearance of statements in only one valence such as 23., 24. only in the first valence with almost the same frequency (30.7) (30.46). A fact that clearly shows that the academic perception of the two statements is unappealable and irrevocable for personalized learning.

Personalized learning requires a new academic perception from current and future teachers. It is a positive fact that individual features of personalized learning are not only readily accepted by respondents but are already implemented in educational systems in different ways. Each school community implements different models of personalized learning and in different contexts. Personalized learning will develop under the influence of the

development of digital and smart-digital technologies with the creation of personalized educational profiles and personalized curricula for students and with positive learning experiences according to the abilities and potential of each student, regardless of whether or not they have SEN.

4.3. PERSONALIZED LEARNING WITH ARTIFICIAL INTELLIGENCE

The application of artificial intelligence in education is changing traditional learning into learning with personalized educational experiences in a digital environment, which is preferred by modern generations in school /generations Z, Alpha and will probably be preferred by generations Beta /. One of the mobile and computer solutions with artificial intelligence is the Duolingo® application. The free version of the DuoLingo Math application, developed by Duocon 2023, was used when working with students, and the "Mathematics" module was selected, since the application is not available in Bulgarian.

The application uses a green animated owl named Duo as a mascot, which reminds you to complete tasks every next day. The module offers mathematical tasks for first and second grade. The free version, available on iOS and Android, was selected and used. When solving the learning tasks, the resource teacher translates, reads and explains the task, since the condition is written in English. The learning tasks are solved both in class and are assigned as homework to the students, relying on the help of a family member to translate, read and explain the condition of some tasks that are not clear to the student in Bulgarian. For the purposes of the empirical study, learning tasks for addition, subtraction, multiplication and division of single-digit and double-digit numbers were used. The specified tasks are related to the individual learning plans of students with SEN. Mathematical problems are solved in a series, with the words “Correct” and “Incorrect” appearing after each solution, with students orienting themselves not by the word itself, but by its colour. For correct execution, the inscription is in green, and for incorrect execution, it is in red. After completing the series of tasks, the application returns to the incorrectly executed task for subsequent re-execution. Until the tasks in the series are solved, the next series is not moved on. In this way, multiple executions or repetitions are engaging and fascinating, students do not have the idea that they are learning mathematics but rather think that they are playing and are engaged in learning. In some cases, it is necessary to explain the task with real three-dimensional figures to the student while he solves the learning task in the application. This is how the two-fold learning of the student with SEN is personalized. Students navigate the presented visual, and audio supports in each learning task and solve the tasks by moving the cursor to the position associated with the correct answer. The student sees the correct performance, as well as the approval for the correct performance by other students who have already completed the task correctly through the red “heart” sign. It also implements control of the performance by the students themselves, i.e. there is self-assessment and assessment by classmates. The correct performance is clearly visible through the green “flag” sign, i.e. there is control of the performance by the students themselves, i.e. there is self-assessment and assessment by classmates. After the student chooses the answer, which is coloured green, i.e. the correct answer, the green inscription "continue" appears first, and a supporting sound pattern appears. This way the student understands that he has completed the decision correctly. His confidence, self-esteem and A-efficiency increase. The other students have not yet solved the task, therefore the approval sign, the "heart" is still blue, and the digital indicator is "0". The students react emotionally positively and are self-stimulated and motivated to continue the next task in the series.

When performing the mathematical operation "adding two-digit numbers", three tasks are presented, two of which are solved, and the student must choose one correct answer from four answers. The DuoLingo application provides the student with the opportunity to choose and indicate the correct answer. If the task is performed incorrectly, the inscription "Incorrect" appears in red, a red flag and a sound signal, which is associated with regret, incorrectness. In this way, the student is not given edification or criticism, but positivity is introduced even in the case of an incorrect decision. After completing the series of tasks, the application returns to the incorrectly solved tasks /if any/. A new opportunity is provided for analysing the task and solving it correctly. Opportunities for more attempts are provided. Then the series is again ended, and attempts are again provided until the correct solution of the task. In this model, the repeated and subsequent execution of the task is motivating for the student, he demonstrates and master's his own style of learning the mathematical operation. On the other hand, the student moves at his own pace and speed, on his own learning path according to his preferences and according to his potential. The teacher can track the student's progress, get an idea of the student's sensory, cognitive and emotional preferences, and track behavioural patterns in the learning process, i.e. get information about the student's educational profile. In this way, the DuoLingo application creates the opportunity to implement personalized learning in compliance with the Universal Design for Learning Framework.

Similar are the mathematical problems with the mathematical operation's "subtraction", "multiplication", "division". Instead of using the conventional way of writing in an empty square, the student moves the arrow to a place that represents the number that is the correct solution. There are no marked markers for divisions on the axis, and this provokes spatial orientation, the creation and use of spatial representations and spatial schemes in two-dimensional space when solving the problems.

In the commented model of the Application, which provides digital gamification, the creation of spatial schemes is more imperceptible and easier and more fun for the student. Even when the arrow is not moved exactly, but there is an approximation, a correct result is reported. When the student sees the answer and the incorrect, but only the approximate indication of the correct answer, a comment follows that he was close but moved the arrow incorrectly. In this commentary, learning is realized through the assessment of mistakes made. And learning through the analysis of mistakes made is very effective because it develops analytical abilities or the mental operations "analysis", "comparison" and "summary", etc. and leads to the formation of the soft competence "responsibility for one's own behaviour". In addition to the option with flasks that denote "greater" and "less", a mathematical task appears with a horizontal scale presented with specific divisions and markings. The student moves the arrow to the appropriate division that corresponds to the correct solution of the task. The appearance of the inscription "Continue" in green is a clear indication and a clear signal for the student that he has solved the task correctly. The student receives a qualitative assessment. It is completely possible to track the student's progress, and the student himself can self-assess. If the solution is correct, a green inscription "Good job", a green flag and an audio stimulus for approval appear. Thus, the student can orient himself for the correct execution through visual and audio stimuli for the correct solution.

The type of multiplication tasks in which there are provided answers for choice with one square and squares arranged in a vertical row are easy and understandable for students with SEN. Students, without being required to count, indicate answers. A guessing effect is triggered but based on a common mental scheme for more and less. At the same time, the visual representation of the correct answer by colouring it in green, as well as the visual and audible

receipt of the "continue" sign, motivates students to solve the next task. There is an increase in the self-esteem and confidence of students with SEN that they can cope, that they have an achievement and success. After completing the mathematical tasks in the respective series, an image is obtained, which with a visual support of the entire image in green, of a smiling "owl" in green and a pleasant sound stimulus. Despite the prompt to correct missing correct solutions, students with SEN accept the prompt with a desire and readiness to reach a correct solution. There is positive support included in the application and the teacher does not have to prompt or require re-solving of incorrectly solved tasks. It is quite clear for students and for the teacher that the positive assessment is with the smiling "owl" in green colour of DuoLingo and the additional appearing more realistic image figure of a person as a smiling student.

In conclusion, it can be noted that the DuoLingo application can be effectively applied for personalized learning for students with SEN, and it would also be useful for students without SEN. In the mobile application, multisensory presentation and multisensory assessment are seen, the implementation of the learning task by doing and an emotionally positive reaction from the student appears when the task is correctly completed, i.e. the three requirements for universal design for learning are present. Through the application, personalized learning outlines learning paths according to the needs, strengths and potential of the student, as well as the possibilities of personalized learning to realize inclusive education in its comprehensive dimension or for all students.

Personalized learning with the application of digital technologies, in particular models using artificial intelligence, is a real predictor for the implementation of inclusive education for children and students with SEN.

4.4. ASSESSMENT OF STUDENT PROGRESS

The assessment of the progress of students with SEN according to the conducted educational experiment with the DuoLingo application as a smart digital technology is implemented according to an author's assessment scale. A scale for assessing the progress of students when using DuoLingo by parents and teachers has been introduced.

Cronbach's Alpha reliability (all items) is 0.917 for all 30 items, indicating that the questionnaire exhibits internal consistency that does not change when an item is deleted.

Variables	Average values on the scale if the corresponding item is removed	Dispersion scale, if the corresponding item is removed	Adjusted items – Overall correlation	Cronbach's alpha if the corresponding item is removed
item 1	140,2059	532,168	0,612	0,912
item 2	139,8235	541,362	0,526	0,914
item 3	139,7353	527,110	0,509	0,914
item 4	140,1765	565,604	0,403	0,916
item 5	140,5294	515,893	0,727	0,910
item 6	140,8235	553,059	0,532	0,915
item 7	139,7353	519,958	0,461	0,916
item 8	140,1765	532,816	0,648	0,912
item 9	140,2059	556,835	0,393	0,916
item 10	139,9412	550,966	0,435	0,915
item 11	140,6765	549,256	0,574	0,914
item 12	140,9118	538,447	0,485	0,914
item 13	140,0882	551,174	0,438	0,915
item 14	141,1176	541,743	0,538	0,914
item 15	139,7647	542,064	0,448	0,915
item 16	140,1765	520,029	0,619	0,912
item 17	141,0588	529,209	0,446	0,916
item 18	140,1471	538,311	0,594	0,913
item 19	139,3529	555,932	0,337	0,916
item 20	140,0294	519,423	0,633	0,912
item 21	139,8824	534,107	0,484	0,914
item 22	139,6176	538,728	0,516	0,914
item 23	139,7647	532,610	0,669	0,912
item 24	140,0294	545,120	0,435	0,915
item 25	140,3235	536,650	0,643	0,912
item 26	140,7059	506,396	0,632	0,912
item 27	140,0000	542,121	0,448	0,915
item 28	140,0882	533,295	0,388	0,917
item 29	140,5588	535,951	0,540	0,914
item 30	139,3529	567,993	0,220	0,917

Statistics		
Medium		
Number	Validity 34	34
	Lack 0	0
Mean		4,8333
Standard Error		0,13703
Median		5,0000
Mode		5,33[a]
Standard Deviation		0,79903
Variance		0,638
Asymmetry or Skewness Coefficient		-0,716
Standard Error of Skewness		0,403
Kersus		0,331
Standard Error of Kursus		0,788
Range		3,60
Minimum		2,67
Maximum		6,27
Quartiles	25	4,3083
	50	5,0000
	75	5,3667
	Multiple modes. The smallest value is shown.	

Table 8. Psychometric characteristics of the scale

The data shows that the survey presents a clustering around the mean value 4.833. The variance of 0.638 indicates that the data is clustered around the mean value, but there is moderate dispersion with a standard deviation of about 0.8 or the respondents have provided relatively uniform responses. The total raw score shows the raw results or the sum of the correct responses i.e. the initial representation of the data from the items marked by the respondents.

Table 9 shows that the data show a normal distribution of the responses provided by the respondents on the individual items. The standard deviation is 0.799 with a mean of 4.83, which means good consistency, low variation in the responses on the individual items by the respondents, i.e. the data are not scattered.

Fig.36

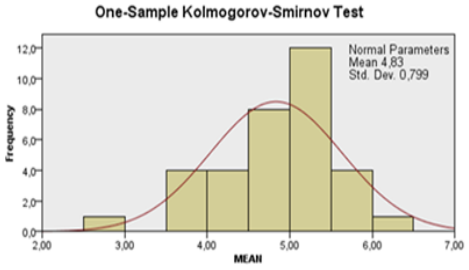


Table 9.Results by ANOVA

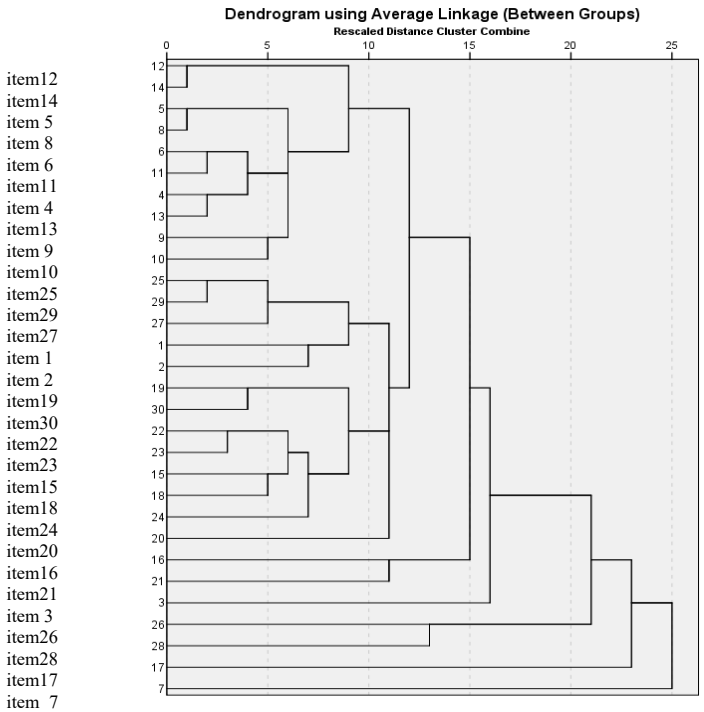
ANOVA

		sum of squared deviations	df degrees of freedom	Mean squared error	F Fisher's exact test	Sig significance level
Among respondents		632,067	33	19,154		
Within the respondent group	Between items	210,784	29	7,268	4,562	0,000
	Residual value	1524,816	957	1,593		
	Total	1735,600	986	1,760		
Total		2367,667	1019	2,324		

Overall average = 4,8333

The statistical processing of the data is presented in Table 9. by ANOVA method, which shows whether there are **statistically significant differences between the mean values of three or more independent groups**. As can be seen from the level of significance 0.000 the probability of error is 0% or the result is **extremely statistically significant**. **The high value of Fisher's criterion is also indicative of the statistical significance of the results obtained.** For the interpretation of the obtained results, a cluster analysis was performed, presented in Fig. 37.

Fig. 37.



The presented Dendrogram clearly outlines seven large clusters in ascending order: **Cluster 1**. The first grouping is of item 12. with item 14. The next grouping is of four thrushes, which include item 5. and item 8., connected with a generalized thrushes of two groupings: of item 6. and item 11. and of item 4. and item 13., and a separate grouping of item 9. and item

10.. **Cluster 2. The clustering includes 13 items and includes items 25 and 29, united by item 27.** The clustering is summarized by items 1 and 2 and is not surprising even for students with SEN, because they use assistive technologies of medium and high level and have attitudes and skills to use electronic devices. This is followed by a clustering of items 19 and 30 and a further more comprehensive clustering of items 22 and 23, items 15 and 18; and the added items 24 and 20. **Cluster 3.** A connection of items 16. and 21. is presented. **Cluster 4**. Only one item 3 is added. **Cluster 5**. Fifth grouping adds items 26. and reversibly grouped 28. with a horizontal length equal to the third grouping. Cluster 6. The sixth grouping is with item 17. they draw a generalized opinion as a conclusion from the respondents. **Cluster 7**. The seventh, highest class grouping is with item 7. From the presented groupings in the cluster analysis, a clear position of approval and noting of increased school achievements, personal development and progress of students with SEN by the respondents, a higher level of independence, coping and personal safety for students with SEN is outlined.

The cluster analysis was also performed using agglomeration indicators, presented in Table 10. From the coefficient in the agglomeration graph and the Dendrogram, it can be seen that there are sharp jumps in the individual clusters associated with individual items.

Table 10

Agglomeration Schedule

Stage	Cluster Combined		Coefficients	Stage Cluster First Appears		Next Stage
	Cluster 1	Cluster 2		Cluster 1	Cluster 2	
1	12	14	13,000	0	0	19
2	5	8	20,000	0	0	14
3	6	11	23,000	0	0	8
4	4	13	27,000	0	0	8
5	25	29	28,000	0	0	11
6	22	23	36,000	0	0	13
7	19	30	38,000	0	0	17
8	4	6	38,500	4	3	12
9	9	10	45,000	0	0	12
10	15	18	49,000	0	0	13
11	25	27	51,000	5	0	18
12	4	9	52,750	8	9	14
13	15	22	66,500	10	6	16
14	4	5	56,500	12	2	19
15	1	2	65,000	0	0	18
16	15	24	97,000	13	0	17
17	15	19	76,600	16	7	20
18	1	25	77,500	15	11	21
19	4	12	78,125	14	1	23
20	15	20	91,714	17	0	21
21	1	15	93,500	18	20	23
22	15	21	94,000	0	0	25
23	1	4	105,292	21	19	25
24	26	28	109,000	0	0	27
25	1	16	122,043	23	22	26
26	1	3	135,120	25	0	27
27	1	26	171,000	26	24	28
28	1	17	187,607	27	0	29
29	1	7	206,621	28	0	0

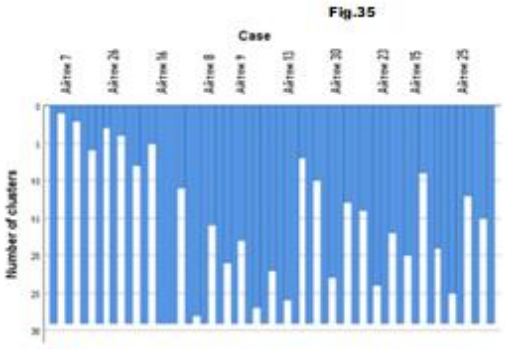


Fig.35

The clustering reflected in Fig.38. by cases or homogeneity clearly covers all items in 10 distinct cases: 7., 26., 16., 8., 9., 13., 30., 23., 15., 25. The clustering by cases demonstrates a positive acceptance and synergistic evaluation by the respondents of the obtained, clear and visible progress of students with SEN when using DuoLingo. The results are presented with specific data in Table 11.

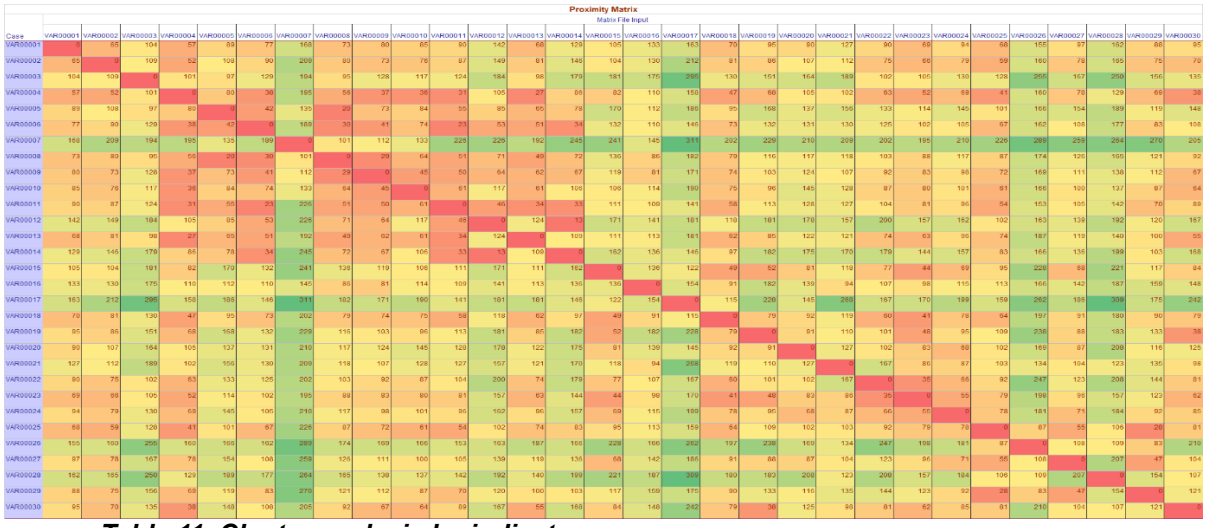


Table 11. Cluster analysis by indicators.

The data from the cluster analysis by indicators and by cases provided a guideline for searching for correlations in the data obtained. Table 19. presents the Correlation Matrix, which highlights:

- **very strong, perfect correlation** between items 5. and 6., 8. and 5., 8. and 6., 12. and 14. The very strong, perfect correlation emphasizes the role of personalized learning in implementing

The indicated items /5., 6., 8., 12., 14. / appear in different positions with the other items of the scale both in very strong and strong correlation dependence, and in relationships with negative correlation dependence. The indicated derived relationships of the items in different dependencies demonstrate the respondents' fluctuations regarding the strength of the items themselves in different dependencies with the other items

- **strong correlation** between items 3 and 5, 5 and 7, 7 and 8, 9 and 7, 9 and 8, 5 and 11, 12 and 8, 12 and 9, 12 and 11, 5 and 13, 11 and 13, 6 and 14, 8 and 14, 11 and 14, 14 and 17, 15 and 17, 15 and 18, 15 and 19, 15 and 23, 23 and 18, 24 and 19, 25 and 26, 25 and 29, 26 and 29, 27 and 29., 27. and 30.

The most important and interesting for the research goals are the relationships between item 11.

- The most important and interesting for the research goals are the relationships between item 11. "I am against the constant use of digital technologies in education" and item 13. "The student increased his success in other subjects after he started studying with the Application."

While item 9. increases its value, item 6. decreases its value. The emergence of a negative moderate relationship is logical, because the Duo Lingo Application is not perceived as artificial intelligence, but only as an interactive Application and as a game in which the student with SEN achieves success and learns while having fun, i.e. they perceive learning as fun.

Correlation Matrix

Correlation	VAR00001	VAR00002	VAR00003	VAR00004	VAR00005	VAR00006	VAR00007	VAR00008	VAR00009	VAR00010	VAR00011	VAR00012	VAR00013	VAR00014	VAR00015	VAR00016	VAR00017	VAR00018	VAR00019	VAR00020	VAR00021	VAR00022	VAR00023	VAR00024	VAR00025	VAR00026	VAR00027	VAR00028	VAR00029	VAR00030
VAR00001	1,000	0,513	0,494	0,405	0,479	0,336	0,397	0,424	0,175	0,239	0,145	0,121	0,379	0,156	0,285	0,254	0,332	0,420	0,357	0,503	0,237	0,414	0,498	0,277	0,428	0,401	0,305	0,240	0,393	0,161
VAR00002	0,513	1,000	0,392	0,361	0,405	0,308	0,135	0,335	0,186	0,206	0,259	0,163	0,163	0,164	0,171	0,246	0,167	0,278	0,174	0,368	0,255	0,394	0,407	0,331	0,517	0,446	0,387	0,188	0,552	0,083
VAR00003	0,494	0,392	1,000	0,513	0,646	0,491	0,356	0,526	0,209	0,300	0,443	0,291	0,458	0,349	0,032	0,254	0,060	0,286	0,076	0,280	0,105	0,462	0,419	0,300	0,328	0,206	0,122	0,045	0,298	-0,022
VAR00004	0,405	0,361	0,513	1,000	0,501	0,242	-0,012	0,244	-0,089	0,382	0,430	-0,108	0,578	0,068	0,019	0,107	0,152	0,321	0,053	0,177	0,028	0,481	0,426	-0,009	0,435	0,290	0,000	0,303	0,301	0,208
VAR00005	0,479	0,405	0,646	0,501	1,000	0,842	0,618	0,922	0,515	0,506	0,664	0,531	0,618	0,572	0,089	0,471	0,231	0,404	0,108	0,363	0,246	0,353	0,388	0,125	0,324	0,373	0,123	0,229	0,281	0,079
VAR00006	0,336	0,308	0,491	0,242	0,842	1,000	0,426	0,899	0,447	0,253	0,560	0,543	0,487	0,631	-0,010	0,361	0,115	0,257	0,070	0,205	0,179	0,172	0,211	0,005	0,206	0,200	0,100	0,045	0,158	0,007
VAR00007	0,397	0,135	0,356	-0,012	0,618	0,426	1,000	0,704	0,735	0,524	0,086	0,329	0,189	0,270	0,043	0,539	0,203	0,189	-0,022	0,290	0,253	0,207	0,207	0,165	0,084	0,253	-0,027	0,193	0,018	-0,083
VAR00008	0,424	0,335	0,526	0,244	0,922	0,899	0,704	1,000	0,714	0,379	0,546	0,611	0,512	0,622	-0,009	0,511	0,210	0,290	0,060	0,313	0,252	0,261	0,285	0,030	0,205	0,293	0,031	0,192	0,103	0,034
VAR00009	0,175	0,186	0,209	-0,089	0,515	0,447	0,735	0,714	1,000	0,374	0,228	0,609	0,073	0,535	-0,167	0,507	0,125	0,078	-0,165	0,107	0,174	0,157	0,093	-0,103	0,074	0,225	-0,137	0,247	-0,112	-0,082
VAR00010	0,239	0,206	0,300	0,382	0,506	0,253	0,524	0,379	0,374	1,000	0,373	0,272	0,233	0,358	0,048	0,278	0,180	0,204	-0,058	0,016	0,045	0,219	0,180	0,001	0,375	0,352	0,095	0,296	0,342	-0,014
VAR00011	0,145	0,259	0,443	0,430	0,664	0,560	0,086	0,546	0,228	0,373	1,000	0,641	0,674	0,699	0,169	0,328	0,209	0,412	0,208	0,191	0,152	0,324	0,393	0,081	0,368	0,281	0,091	0,305	0,322	0,272
VAR00012	0,121	0,163	0,291	-0,108	0,531	0,543	0,329	0,611	0,609	0,272	0,641	1,000	0,116	0,924	0,128	0,338	0,142	0,231	0,148	0,169	0,283	-0,016	0,144	0,001	0,279	0,345	0,235	0,227	0,202	0,036
VAR00013	0,379	0,163	0,458	0,578	0,618	0,487	0,189	0,512	0,073	0,233	0,674	0,116	1,000	0,194	0,014	0,269	0,164	0,324	0,151	0,185	0,106	0,379	0,380	0,039	0,183	0,175	-0,096	0,267	0,159	0,325
VAR00014	0,156	0,164	0,349	0,068	0,572	0,631	0,270	0,622	0,535	0,358	0,699	0,924	0,194	1,000	0,182	0,364	0,238	0,374	0,168	0,160	0,194	0,129	0,241	-0,038	0,390	0,296	0,233	0,172	0,245	0,024
VAR00015	0,285	0,171	0,032	0,019	0,089	-0,010	0,043	-0,009	-0,167	0,048	0,169	0,128	0,014	0,182	1,000	0,279	0,717	0,647	0,603	0,589	0,285	0,440	0,655	0,493	0,299	0,165	0,528	-0,033	0,320	0,083
VAR00016	0,254	0,246	0,254	0,107	0,471	0,361	0,539	0,511	0,507	0,278	0,328	0,338	0,269	0,364	0,279	1,000	0,477	0,465	-0,078	0,360	0,552	0,463	0,466	0,341	0,314	0,433	0,218	0,254	0,144	-0,059
VAR00017	0,332	0,167	0,060	0,152	0,231	0,115	0,203	0,210	0,125	0,180	0,209	0,142	0,164	0,238	0,717	0,477	1,000	0,594	0,306	0,551	0,029	0,551	0,444	0,176	0,262	0,133	0,289	-0,009	0,195	0,033
VAR00018	0,420	0,278	0,286	0,321	0,404	0,257	0,189	0,290	0,078	0,204	0,412	0,231	0,324	0,374	0,647	0,465	0,594	1,000	0,378	0,453	0,209	0,577	0,668	0,316	0,381	0,157	0,265	0,078	0,317	0,130
VAR00019	0,357	0,174	0,076	0,053	0,108	0,070	-0,022	0,060	-0,165	-0,058	0,208	0,148	0,151	0,188	0,603	-0,078	0,306	0,378	1,000	0,547	0,269	0,070	0,568	0,216	0,138	0,168	0,341	0,106	0,251	0,313
VAR00020	0,503	0,368	0,280	0,177	0,363	0,205	0,290	0,313	0,107	0,016	0,191	0,169	0,185	0,160	0,569	0,360	0,551	0,453	0,547	1,000	0,371	0,457	0,532	0,619	0,394	0,441	0,520	0,162	0,408	0,131
VAR00021	0,237	0,255	0,105	0,028	0,246	0,179	0,253	0,252	0,174	0,045	0,152	0,283	0,106	0,194	0,265	0,552	0,029	0,209	0,269	0,371	1,000	-0,032	0,443	0,452	0,343	0,590	0,371	0,491	0,274	0,254
VAR00022	0,414	0,394	0,462	0,481	0,353	0,172	0,207	0,261	0,157	0,219	0,324	-0,016	0,379	0,129	0,440	0,463	0,551	0,577	0,070	0,457	-0,032	1,000	0,722	0,526	0,354	0,108	0,132	0,033	0,165	-0,015
VAR00023	0,498	0,407	0,419	0,426	0,388	0,211	0,207	0,285	0,093	0,180	0,393	0,144	0,380	0,241	0,655	0,466	0,444	0,668	0,568	0,532	0,443	0,722	1,000	0,551	0,353	0,268	0,255	0,244	0,198	0,227
VAR00024	0,277	0,331	0,300	-0,009	0,125	0,005	0,165	0,030	-0,103	0,001	0,081	0,001	0,039	-0,038	0,493	0,341	0,176	0,316	0,216	0,619	0,452	0,526	0,551	1,000	0,322	0,294	0,459	0,096	0,373	0,061
VAR00025	0,428	0,517	0,328	0,435	0,324	0,206	0,084	0,205	0,074	0,375	0,368	0,279	0,183	0,390	0,299	0,314	0,262	0,381	0,138	0,394	0,343	0,354	0,353	0,322	1,000	0,727	0,578	0,516	0,794	0,254
VAR00026	0,401	0,446	0,206	0,290	0,373	0,200	0,253	0,293	0,225	0,352	0,281	0,345	0,175	0,296	0,165	0,433	0,133	0,157	0,168	0,441	0,590	0,108	0,268	0,294	0,727	1,000	0,665	0,686	0,706	0,309
VAR00027	0,305	0,387	0,122	0,000	0,123	0,100	-0,027	0,031	-0,137	0,095	0,091	0,235	-0,096	0,233	0,528	0,218	0,289	0,265	0,341	0,520	0,371	0,132	0,255	0,459	0,578	0,665	1,000	0,020	0,741	-0,139
VAR00028	0,240	0,188	0,045	0,303	0,229	0,045	0,193	0,192	0,247	0,296	0,305	0,227	0,267	0,172	-0,033	0,254	-0,009	0,076	0,106	0,162	0,491	0,033	0,244	0,096	0,516	0,686	0,020	1,000	0,325	0,785
VAR00029	0,393	0,552	0,298	0,301	0,281	0,158	0,018	0,103	-0,112	0,342	0,322	0,202	0,159	0,245	0,320	0,144	0,195	0,317	0,251	0,408	0,274	0,165	0,198	0,373	0,794	0,706	0,741	0,325	1,000	0,184
VAR00030	0,161	0,083	-0,022	0,208	0,079	0,007	-0,083	0,034	-0,082	-0,014	0,272	0,036	0,325	0,024	0,063	-0,059	0,033	0,130	0,313	0,131	0,254	-0,015	0,227	0,061	0,254	0,309	-0,139	0,785	0,184	1,000

Table 12. Correlation matrix.

For a clearer visualization of the distribution of the values of the respondents' responses as a characteristic of the scale on the individual items by clusters, it is presented in Boxplot Diagram in Fig. 39.

Fig. 39.

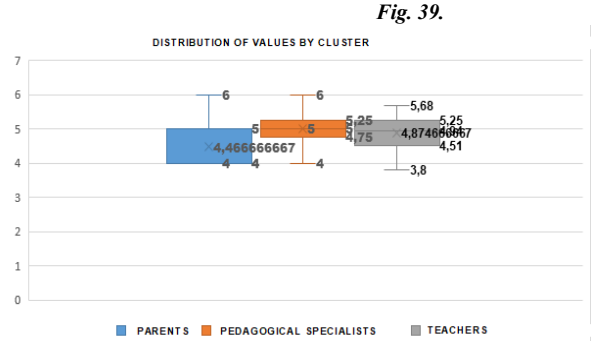
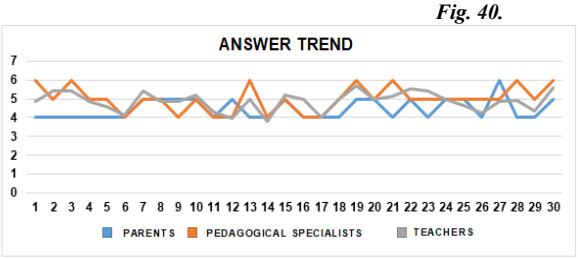


Fig. 40.



The individual clusters present the profile of responses of the individual groups of respondents. It is evident that synergy is achieved in the responses of the respondents, while in the space of high clustering values among the respondents, which indicates positive acceptance and high appreciation of the progress of students with SEN in using the DuoLingo mobile application. The dispersion of the three clusters is minimal, but the range of their values with the values of the other clusters is clearly outlined.

In this regard, the trend of the responses of the three groups is interesting, which is presented in Fig. 40. A dispersion of responses from the three groups of respondents is clear, except for the first six items, and in items 12, 13, 19, 21 and 28.

The interpreted results and facts show an extremely positive assessment of the use of the mobile application /as a smart digital technology/, the personalization of learning and the progress of students with SEN.

The interpreted results and facts show an extremely positive assessment of the use of the mobile application /as a smart digital technology/, the personalization of learning and the progress of students with SEN. The respondents categorically reported that the mobile application contributed to the personalization of the learning of the individual student with SEN with the opportunities for formative assessment. The application is considered fun, easy and enjoyable by the respondents. Increased success rates of SEN students in both mathematics and

other subjects are also reported. The motivation for success among students with SEN has increased. The respondents assess that students perceive failures not as failures, but as opportunities for new attempts to be successful.

Timely feedback in the mobile application allows the cognitive and emotional engagement of the student to remain in action when corrections are made for errors. The student remains in the "flow", and this state supports a higher level of concentration and elimination of random stimuli. In the "flow" state, deep learning is realized, i.e. information is more easily positioned in long-term memory, and learning becomes a pleasure and positive experience.

CONCLUSIONS

The scientific research on personalized learning began in the period when it was being popularized as a new trend in education systems. In the initial period of the dissertation research, personalized learning was mainly associated with the strengths of pupils with SEN, identified through their sensory, cognitive and behavioural preferences for learning; their interests and desires; and an unquestionable consideration of their needs. Based on the obtained and analysed results of the theoretical and empirical study on personalized learning – a predictor of the inclusion of students with SEN, the following conclusions are reached:

- Understanding the philosophy and concept of inclusion through inclusive education has its own dynamics and evolution: from models of understanding and as a scientific and applied concept from the independent and singular understanding of each student's own pace of learning in a learning environment to digitally inclusive education.
- The concept of inclusive education can be viewed in a narrow and a broad sense.
- The clarification of the nature and definitions of inclusive education are influenced by inclusive policies and practices in different countries, as well as by its social acceptance without prejudice by the school as an institution.
- Personalized learning:
  - is influenced by many theories of education and the application of individual its components are found in education throughout its history.
  - has its own architectonics of components, attributes and characteristics that are related to the effective implementation of the process of inclusive education for all students.
  - is a real predictor of the implementation of inclusive education for students with SEN when digital technologies are used, in specific models with the use of artificial intelligence.
- Current teachers have a comprehensive and positive academic perception of the implementation of personalized learning as a new educational approach and a new educational phenomenon.
- The teachers' reflection on personalized learning reveals fluctuations in reflective control over the objectification of subjective pedagogical experience regarding its application in an educational environment.
- To implement personalized learning as a factor for the inclusion of students with SEN, it is necessary to take into account the strengths and potential of students in conditions of widespread digitalization of education
- The conclusions drawn give reason to assume that the aim of the study has been achieved.

The analysis of the results of the overall theoretical and empirical study established that the following hypotheses can be confirmed:

Hypothesis 1., *which states: "It is assumed that teachers' reflection on personalized learning leads to fluctuations in reflective control over the objectification of subjective pedagogical experience regarding its application in an educational environment",* **is accepted as proven.**

Reflective control is questioned in the respondents' own pedagogical activities, and the intensity of reflective control is hesitant at the border of professional perception throughout and across many items of the personalized learning survey.

Hypothesis 2: *"It is assumed that future and current teachers have a comprehensive and positive academic perception of the implementation of personalized learning as a new educational approach and a new educational phenomenon,"* **was confirmed**.

The academic perception of personalized learning is changing and will continue to change under the influence of teachers' and students' preferences for digital models of learning and mastering information, including educational information; and, undoubtedly, under the influence of the development of digital technologies and the introduction of innovative learning models.

Hypothesis 3: *"It is assumed that in order to implement personalized learning as a factor of inclusive education, it is necessary to take into account the strengths and potential of students in conditions of widespread digitalization of education,"* is **considered proven.**

Personalized learning, especially using the functionalities of digital technologies, creates opportunities for highlighting the strengths of students and revealing their potential for learning and for forming competencies that will be necessary for them in educational, professional and life functioning throughout their lives.

Null hypothesis-0: *"Personalized learning is not a factor for the implementation of inclusive education and does not formulate requirements for additional concepts"*, **was not confirmed**.

The increase in school achievement and motivation for learning among students with SEN who participated in the teaching experiment through personalization with the DuoLingo mobile application clearly demonstrates that personalized learning is a factor for inclusive education. In this regard, personalized learning formulates new concepts for digitally inclusive education and its application in inclusive digital practices.

Personalized learning is being established as a key factor for the inclusion of students with SEN as a tool for ensuring equal access to quality education, as it foregrounds the unique individuality and strengths of learners.

In this regard, the theoretical-empirical research confirmed the relevance and significance of the topic of personalized learning in the inclusion of students with SEN. This dissertation examines the theoretical framework for personalized learning, taking into account perception, reflection, and digitalization in the process of inclusion and support for students with SEN. The analysis of the results of the empirical study outlined the key aspects of personalized learning, demonstrating the need for high professional competence, reflexivity, and readiness for innovation. The use of digital technologies and electronic resources makes it possible to implement personalized learning, in a context-aware learning model. In this aspect, the focus of personalized learning is directed at the student with his needs, but above all with his strengths and potential.

In confirmation of the above, it can be concluded that personalized learning is a multi-layered construct that is a predictor for the implementation of the process of inclusive education for students with SEN.

CONTRIBUTIONS

Contributions of a scientific and theoretical nature

1. An extensive review of the scientific and normative literature on inclusive education in the world and in Bulgaria has been made in a chronological and prospective aspect.
2. A conceptualization of inclusive education in a broad and narrow sense has been introduced for the first time in Bulgaria.
3. A narrative and interpretive analysis of the concept of personalized learning has been implemented.
4. The issue of personalized learning with the application of digital technologies has been developed.

Contributions of a scientifically applied nature

1. An original diagnostic toolkit for reflection and perception has been designed and applied to personalized learning.
2. The effectiveness of implementing personalized learning using digital technologies for children and students with special educational needs has been established.
3. It has been established that the implementation of personalized learning as a factor of inclusive education is related to taking into account the strengths and potential of students with special educational needs in conditions of widespread digitalization of education.

LIST OF PUBLICATIONS ON THE TOPIC OF THE DISSERTATION

1. **Ivanova, K. (2022).** The Inclusive Nature of Personalized Learning. In: Proceedings of the Eleventh Student Forum of the Faculty of Pedagogy. Plovdiv University Publishing House. ISBN 2738-8859.
2. Levterova-Gadjalova, D. & **Ivanova, K. (2023).** Teachers' Reflection on Personalized Learning. Conference ATEE: To be or not to be a great Educator, 225-236. https://doi.org/10.22364/atee.2022.14
3. **Ivanova, K. (2023).** Academic perception of personalized learning. In: Proceedings of the Twelfth Student Forum of the Faculty of Pedagogy. Plovdiv University Publishing House. ISBN 2738-8859.
4. **Ivanova, K. (2024).** Personalized digital learning. In: Proceedings of the Thirteenth Student Forum of the Faculty of Pedagogy. Plovdiv University Publishing House. ISBN 2738-8859.
5. **Ivanova, K.** & Atanasova, Zh. (2024). Assistive technologies in support of personalized learning. In Collection of papers from the Jubilee Conference 40 years of the Faculty of Pedagogy. Plovdiv University Publishing House. ISBN 978-619-7768-12-1.