„BABEȘ-BOLYAI” UNIVERSITY CLUJ-NAPOCA
FACULTY OF PSYCHOLOGY AND EDUCATIONAL SCIENCES
DOCTORAL SCHOOL „EDUCATION, REFLECTION, DEVELOPMENT”

DOCTORAL DISSERTATION

Summary

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Formation and development of digital skills among preschool teachers through the design and implementation of a national continuing professional development program

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CONTENT

Key words: Digital competences; DigCompEdu competence framework; early digital education; digital technologies; educational robots.

We live in an increasingly digitalized society where *gadgets* and digital technologies are becoming indispensable. Adults use these technologies on a daily basis whereas children are starting to have more and more access to them from an early age.

The digital transformation of our society requires education systems that align with the newly emerged societal demands in order to prepare children to consciously use technology in their daily activities. Thus, early education, as the very foundation for later development, cannot remain outside this process. As children are increasingly interacting with digital tools outside the educational setting, there is a need to identify the benefits and challenges of integrating technology into the teaching process.

Traditionally perceived as a space for learning through play, the concept of *kindergarten* can now be seen as an environment where technology can be used constructively to enhance children's learning experiences. Accordingly, the integration of digital technologies into teaching activities provides significant opportunities to stimulate logical thinking, problem solving, critical thinking as well as collaboration in pre-school children.

In order to harness the potential of technology, it is essential that early childhood teachers have strong digital competences. These competences are not limited to the use of digital tools, but also involve the ability to select, adapt and integrate technologies in a pedagogically relevant and effective way. Teachers need to be able to create interactive and engaging learning environments, use quality digital resources and evaluate the impact of technology on children's development.

The legislative framework in Romania emphasizes the importance of digital competences in education. The Law on Pre-university Education No 198/2023 (Ro: LÎP) promotes the integration of digital tools in the teaching process while at the same time emphasizing the need for training teachers' digital competences. They enable teachers to use digital technologies in an effective way in the teaching process, supporting children to actively participate in the activity with the overarching aim of improving learning outcomes (Albulescu, 2021).

The present paper aims to clarify the role technology has in kindergarten activities, but also to shed light on how early childhood teachers can bring innovations into the teaching process through the use of digital applications and tools. By investigating and analyzing these tools ranging from interactive learning platforms to floor robots, we wanted to offer some ways of integrating technology into the teaching process so as to build innovative learning

experiences. The study consists of two parts: the first part focuses on offering sound theoretical substantiation of the problem under observation, while the second part presents research on the training and development of digital competences of early childhood teachers through an intervention program developed on the basis of the *DigCompEdu* digital competence framework.

Based on the study of a vast body of research, the first three chapters of the present dissertation (the theoretical part), taps into prestigious works from the specialized literature and a large number of studies related to the topic addressed in this paper.

The first chapter presents the relevant competences from a professional career standpoint, starting from the conceptual delimitations related to the topic, definitions, analyses, structural elements of digital competences from the teachers' perspective, European Union initiatives and policies regarding the training and development of digital competences and their adoption in our country, as well as important observations on the challenges and opportunities of developing teachers' digital competences, the role of European projects using the *ESEP platform* in professional development. The most important psychological theories underlying learning through digital technologies are also presented and explained.

The second chapter of the study brings into focus the necessity and effectiveness of the use of digital technologies in the teaching process in early childhood education. Encompassing both the conceptualization and a taxonomy of digital technologies in education, this chapter clarifies the integration of digital technologies in the teaching process by creating learning designs on the experiential domains included in the curriculum for early childhood education. Knowing the specifics of early education, we bring clarifications on the creation, development and use of OER, the role and gamification strategies of learning situations, as well as examples of integrating educational robotics into the instructional process defining early education.

The impact of digital technologies on both training and the manifestation of preschoolers' personality from a developmental point of view, as well as the risks and opportunities of using digital technologies in the teaching process, are subsequently analyzed.

The third chapter of the theoretical part of the present study puts forward, based on a thorough analysis of the latest studies in the field, the programs for teachers' in-service professional development as basic tools in the digital skills training, while also using a critical analysis of the in-service professional development programs implemented in Romania during the period between 2017-2024.

Following the comprehensive study of publications in the field, the analysis of studies that have emerged in recent years, we can state the fact that a low level of digital competences in early education teachers and educators is a challenge for a modern educational system having important implications on the efficiency of both the teaching process and one's professional development.

Difficulties that are encountered in integrating digital technology into the teaching process, limited access to digital educational resources, professional networks and communication with parents are some of the negative effects associated with low digital literacy.

In the context of the digitization of education, it is essential to invest in the training and development of teachers' digital competences in order to ensure quality education that is alligned with the needs of the 21st century society.

In this context, part II of the study proposes the implementation of an intervention program *Digital Early Education* in order to verify its effectiveness by analyzing the instructional-educational influences on the digital competences of teachers and educators from early childhood education stipulated by The *DigCompEdu* European Framework and adopted by Romania through *OM 4150/29 July 2022*.

The research objectives focused on the following aspects:

O1. Determining the level of digital competences of early childhood teachers and educators in order to determine the study participants' achieved performance;

O2. Selecting digital technologies and content adapted to the specificities of pre-school education, according to the provisions of the digital competences framework in education (DigCompEdu), in order to design a practical-applicative model (program for in-service professional development *Digital Early Education*) that will contribute to the efficiency of the teaching process;

O3. Designing a program for in-service professional development so as to develop the digital competences of teachers and early childhood educators in Maramureș County in order to streamline the teaching process;

O4. Practical experimentation of the *Digital Early Education* program for in-service professional development;

O5. To analyze the effectiveness of the program for in-service professional development by interpreting and comparing the results obtained by the participating teachers and early childhood educators at pretest and posttest timestamps.

The main research questions that guided our research directions were the following:

1. To what extent will the *Digital Early Childhood Education* in-service professional development program have an impact on increasing the level of digital competences of early childhood teaching staff?

2. To what extent does the level of digital competences of early childhood education teachers and educators contribute significantly to the effectiveness of the teaching process?

3. To what extent does the *Grit* level of early childhood education teachers influence the level of their digital competences?

Consequently, the investigative approach of the research is based on the following general research hypothesis as a starting point of the experiment: *the Digital Early Childhood Education program for continuous professional development designed on the basis of the digital competences framework (DigCompEdu) contributes to the increase in the level of digital competences of teachers and early childhood educators and, inherently, to making the teaching process more effective.*

In order to explain the general hypothesis, four secondary hypotheses have been added, which are closely related to the digital competence framework targeting education professionals (DigCompEdu) and whose effects clarify the general hypothesis. Compared to the general hypotheses, the secondary hypotheses have a lower degree of generalisation and are therefore more specific, adding value to the general hypothesis.

Secondary hypothesis 1: The *Digital Early Childhood Education* program for in-service professional development designed on the basis of the Digital Competence Framework (*DigCompEdu*) will contribute on the one hand to the enrichment of knowledge pertaining to digital technologies and, on the other hand, to the articulation of basic practices of early childhood education teachers (Levels A1 & A2).

Secondary hypothesis 2: *The Digital Early Childhood Education* program developed on the basis of the digital competences framework (DigCompEdu) will contribute to the development and configuration of digital practices of early childhood education teachers and educators (Level B1 & B2).

Secondary hypothesis 3: The Digital Early Childhood Education program developed on the basis of The Digital Competence Framework (DigCompEdu) will help to increase the

expertise of early childhood teachers and educators to create new practices for using digital technologies in an innovative and strategic way in the school community (Level C1 & C2).

Secondary hypothesis 4: The *Digital Early Childhood Education* program for in-service professional development designed on the basis of the Digital Competence Framework (DigCompEdu) will contribute to the streamlining of the teaching process through the selection, creation and use of open educational resources (OER) as well as other digital technologies.

Secondary hypothesis 5: The *Digital Early Childhood Education* program for in-service professional development designed on the basis of the Digital Competence Framework (DigCompEdu) will contribute to the level enhancement of *Grit* of early childhood education teachers and educators, which is considered a predictor of educational and professional success due to its components (passion and perseverance).

Variables that illustrate the relationship between psychological constructs from a causal perspective are the independent and dependent variables, which are of major importance in experimental studies. The independent variable is manipulated by the researcher in the experiment and explains the possibility of change of another variable, measured by the researcher, namely the dependent variable (Popa, 2022).

Independent Variable (I.V.)

The *Digital Early Education Program* for in-service professional development designed on the basis of the *Digital Competence Framework* (DigCompEdu)

Dependent Variables (D.V.)

- **(D.V.1)** the level of knowledge pertaining to digital technologies and articulation of basic practices of early childhood teachers;
- **(D.V.2)** the ability of teachers and early childhood educators to develop and structure their digital practices;
- **(D.V.3)** the ability of teachers and early childhood educators to create new practices for using digital technologies in an innovative and strategic way in the school community;
- **(D.V.4)** streamlining the teaching process through the creation and use of open educational resources (OER) and other digital technologies;
- **(D.V.5)** The Grit level of teachers and early childhood educators, considered a predictor of educational and professional success due to its components (passion and perseverance).

The sample of participants of the present research was selected from the population of early childhood education teachers and educators working in kindergartens in Maramureș

County. A non-probability sampling method was chosen as the sampling method as choosing convenience sampling as the method offers the possibility of having participants in a convenient manner and in a relatively short timeframe (Curelaru, 2022).

Therefore, in order to ensure that the research sample would be a representative one, the sample size was calculated using GPower version 3.1 app.

M. Curelaru (2022) states that a sample is representative of a population to the extent that the participants who make it up have the same characteristics as the individuals in the target population from which participants were selected. In this sense, the representativeness of a sample can be explained statistically through two variable elements such as error and confidence level.

To identify the minimum number of subjects, a standard power of 0.8 was introduced, and to increase the effect of the intervention, a power of 0.95 was introduced. Thus, based on our analyses, we found that a sample of 210 individuals would be suitable for testing our hypotheses. Therefore, the participants were divided into a control group and an experimental group with similar characteristics, intervening with the independent variable (I.V.), i.e. the *Early Digital Education* program for in-service professional development based on the Digital Competence Framework (DigCompEdu) on the experimental group.

After identifying the sample size, a call for recruiting participants to the study was launched to all the zonal methodical centers, which include school units circumscribed to early childhood education in Maramureș County. Therefore, the 211 teachers for early childhood education, expressed in writing their willingness to participate in the study, and were subsequently divided into two groups: the control group consisting of 107 people, all female, and the experimental group consisting of 104 people, of which only one participant is male. The two groups (control and experimental) were intended to be comparable (quantitatively and qualitatively), without grouping the study participants according to any particular considerations.

As part of the experimental research we aimed to run an intervention program, entitled *Digital Early Education Program*, developed on the basis of the European Framework for Teachers' Digital Competence (DigCompEdu), with the aim of providing early education teachers with the opportunity to develop digital skills that facilitate the use of technologies in a responsible and effective way, with an emphasis on their integration into the teaching process.

The program was designed under three modules based on the 22 teacher-specific digital competences, organized according to the 6 competence domains defined by DigCompEdu (Redecker, 2017). Each module addresses two competence domains, from both

a theoretical and a practical-applicative perspective, with a total duration of 90 hours, of which 36 hours are conducted synchronously and 54 hours asynchronously. In our study we carried out 40 hours in face to face format (36 hours for theoretical and practical-applicative notions + 4 hours for deepening knowledge and evaluation of open educational resources (OER) created by the teachers participating in the study). For the asynchronous classes, materials were distributed (PPTs, digital lessons and a package of books from the Syntheses of Pedagogy collection that features representative field-related topics (e-Didactics, Digital Early Education. Theoretical and Applied Frameworks and Early Pre-school Education. Teacher's Guide). Thus, the first module addressed the areas of Professional Engagement and Digital Resources, which focus on (1) the appropriate use of digital technologies by teaching staff in peer/parent/other stakeholders communication and collaboration, and (2) selecting, creating, modifying and managing open educational resources.

Module II addresses the areas of Teaching & Learning and Assessment, which refer to integration strategies of digital technologies into the teaching process. Module III focusses on the last two areas such as Pre-schooler Engagement and Facilitating the acquisition of digital skills by pre-schoolers. The latter includes exemplifying ways of using digital technologies, respecting the needs, age particularities and developmental level of each child.

The proposed contents have been selected according to the specific aspects of early childhood education, emphasizing the use of appropriate digital technologies and their integration into the teaching process in an effective way.

An example of an activity from Module II is presented below:

TOPIC 9: Integration of educational robotics in the teaching process of early education

AIM OF THE ACTIVITY: Familiarizing teachers with the principles of operation of six types of robots and their integration in the teaching process.

ADDRESSED CONTENT:

- Educational robotics. A diachronic and synchronic analysis;
- Types of educational robots used in early childhood education. Ethical, inclusive, methodical, technical, and programming benchmarks (*Robobloq Qobo; Robot Mouse; Bee-Bot; Ozobot Bit și Evo; Edison; LEGO® Education Spike Essential*);
- Ways of integrating educational robots in the teaching/learning process. Exemplification.

In the first part of the activity a series of theoretical notions were introduced on the principles of operating and programming educational robots, while in the second part of the activity educational robots were presented: *Robot Mouse*, *Blue-Bot*, *Bee-bot, Robobloq Qobo,*

Ozobot, Edison). The emphasis was placed on the practical-applicative part for exemplification and practice of their introduction in the specific teaching process of early education.

The activity has ended with the presentation of integration strategies of educational robots into teaching activities, emphasizing that they can be considered effective tools for project-based learning where STEM education, coding, computational thinking and engineering skills are integrated in a single project (Catalano & Mestic, 2024). Additionally, in order to deepen the notions presented in the activity, participants received a QR code directing them to the blog entitled *Practical applications of using floor robots in the learning process.*

Figure IV.15. QR code-types of robots

We want that through the topical content addressed in the *Digital Early Education Program*, pre-school education teachers are enabled to improve their digital competences in order to be able to effectively integrate technologies in their professional development, but also in their teaching process.

Methods and Research instruments

In the present research study, both quantitative methods (questionnaire based survey, experiment) and qualitative methods (analysis of school documents, focus group, analysis of products created by the study participants) were used. Most of the studies highlighted through the PRISMA methodology (Su & Yang, 2024; Suryani et al., 2024; Suryani et al., 2024; Tveiterås & Bjørner, 2024; Madsen et al., 2023; Urrea-Solano et al., 2021) have chosen to combine quantitative and qualitative methods as their research methodology. Moreover, the authors mention that the most common data collection instruments were questionnaires, interviews and focus groups.

The methods used in our research represent its methodological approach, in which they combine and influence each other in order to verify the effectiveness of the Digital Early

Education continuous education program, developed to optimize the digital competence of pre-school teachers. Thus, the research methods used in collecting the data necessary for the study will contribute to improving digital practices and, subsequently, to streamlining the teaching process. The research methods used in the study were: the analysis of school documents, the focus group, the questionnaire-based survey, the experiment and the analysis of the products made by the study participants. At the same time, the following tools were used: the *SELFIE for TEACHERS* questionnaire, the Romanian version (Annex 1), a version of *The Grit Scale*, designed by Angela Duckworth (Annex 2), the focus group question grid (Annex 3) and the digital portfolio stored in Google Drive.

The present research was carried out in three consecutive stages:

(1) The pre-experimental stage comprises four steps:

(A) identification of the problems faced by the teachers participating in the study by means of the focus-group method, which are to be solved in the following stages; (B) linguistic validation of the *SELFIE for TEACHERS* questionnaire, taking into account the guidelines of *The International Commission for Testing and Adaptation of Tests* (ITC); (C) the measurement of the level of digital competences of the teachers participating in the study by applying the *SELFIE for TEACHERS* questionnaire, the Romanian version; and (D) measuring the level of *Grit* of the study participants using *the Grit Scale.*

(2) Experimental stage: this is an important step as the *Digital Early Education* intervention program is being implemented in this stage, taking into account the fact that the proposed activities will improve the level of digital competences that will increase professional performance related to the use of digital technologies;

(3) Post-experimental stage: a stage in which the outcomes generated by the actions carried out are analyzed, based on the data collected using the *SELFIE for TEACHERS* questionnaire, the version in Romanian, the Grit scale and the OERs created by the study participants.

In order to be able to confirm the secondary hypotheses proposed in the action research, the achievement of the two objectives aimed at verifying (O4) and examining (O5) the effectiveness of the *Digital Digital Education* continuous professional development program was monitored. To this end, a quasi-experimental design was proposed, as it is suitable for control and experimental groups in which participants were divided in a different way than by randomization. Following the classical experimental design model, there is a control group, which serves as a comparison reference with the group that has been experimentally influenced in order to test the causal relationship between the independent and the dependent variables.

Consequently, the major difference between a classical experimental design and a quasi-experiment consists in the formation of control and experimental groups by a method other than randomization (Vîrgă & Tisu, 2022). For dividing the sample of participants into the two groups (control and experimental), the convenience sampling method was used, as we wanted the study participants to show willingness and involvement. This method has the advantage of involving research participants in a research-friendly manner as they get engrossed in the proposed activities in the short and medium term (Curelaru, 2022).

In the following part of the present study we will present the research results so as to demonstrate that the intervention program has had a positive and significant effect, contributing to the improvement of the digital literacy level of the teachers participating in the study.

The data obtained through the used methods and instruments were analyzed using the software program called Statistical Package for the Social Sciences (SPSS) version 29. In order to test the formulated hypotheses, nonparametric tests were used, since the data distribution did not fulfill the conditions of normality, according to the results indicated by the two tests Kolmogorov-Smirnov and Shapiro-Wilk. Therefore, in order to highlight the differences between the two independent groups (control and experimental), we used the Mann-Whitney U test which allowed us to find out if there was a significant difference between the means of the ranks of the analyzed variables. In addition, to investigate the relationship between two variables with an abnormal distribution of the data, Spearman correlations were used to provide information about the strength and direction of the association between them whereas linear regression was used to analyze how a variable considered as a predictor can influence a result variable. In the following we present the results obtained in the research.

Pretest and Posttest Results Comparison

In the first stage the data collected through the *SELFIE for TEACHERS* questionnaire were analyzed. Therefore, the Mann-Whitney U test was used to calculate the differences between the pre-experimental and post-experimental stages in order to find out whether the independent variable (*Digital Early Education* intervention program) has had an effect on the dependent variables (V.D.1; V.D.2; V.D.3; V.D.4; V.D.5). Thus, the obtained results demonstrate that the proposed program had an impact on the dependent variables, indicating a significant difference between the two stages of the research. Thus, the participants experienced a significant increase ($Z = -7.67$, $p < .001$) in the level of digital competences. An important result was represented by the fact that no participant recorded a decrease in the level of digital competences, on the contrary, 73 participants reported an improvement and 138 remained at the same level respectively.

To test the dependent variable (V.D.4) *the streamlining of the teaching process through the creation and use of open educational resources (OER) and other digital technologies,* the Mann-Whitney U test was used, which indicated the differences between the pre-experimental and post-experimental stages in the two groups (control and experimental). As can be seen in Table V.15, there are no major changes among the teachers in the control group in any of the analyzed areas. The results obtained through Mann-Whitney U test for each category proved that the Alpha threshold indicated a p-value > 0.05, which means that the differences between pre-test and post-test are not statistically significant.

The experimental group showed significant improvements in all domains: (1) Professional engagement: 1.86 → 3.05; (2) Digital resources: 1.69 → 2.90; (3) Pedagogical practice: 1.60 → 2.73; (4) Assessment: 1.52 → 2.65; (5) Empowering students: 1.40 → 2.56, (6) Facilitating digital competence: 1.34 → 2.43. Mann-Whitney U test results ($p < 0.001$) confirm that these improvements are statistically valid. The competence domain scores were calculated as the average of the scores of the items of which they are composed. According to the data shown in Table V.15., each digital competence domain was positively influenced by the intervention program, with the largest increases in three of the domains typically rendering the teaching process more effective, such as: use of digital resources, improvement of pedagogical practices in teaching - learning - assessment. Therefore, the findings obtained from the comparative analysis of the results obtained by the control and experimental groups in the two stages (pre and post) were presented, highlighting the significant impact that the intervention program had on the level of digital competences held by the teachers participating in the study. This finding is supported by the assertion that structured educational interventions, even shorter ones, can improve teachers' digital literacy levels (Redecker & Punie, 2017).

In the second stage of the analyses the data collected through the *Grit Scale* were analyzed. Thus, through the Mann-Whitney U test, the differences between the pre-experimental and post-experimental stages were calculated in order to find out whether the independent variable (*Digital Early Education intervention program*) had an effect on the dependent variable (V.D.5) *early education teachers' and educators' level of Grit, considered as a predictor of educational and professional success due to its components (passion and perseverance).* The results show that in the experimental group there were significant differences in the level of *Grit* recorded between the two stages of the research ($Z = -6.75$, $p < .001$). 75 participants showed an increase in the *Grit* score, where 13 teachers recorded a slight decrease and 123 did not register any changes.

Due to the increase in the post-experimental level of *Grit*, as far as the experimental group is concerned, we considered it appropriate to achieve a linear regression to examine the relationship between the level of *Grit* and the digital skills held by the teachers participating in the study. According to the results, the model, in which we introduced digital competences as a dependent variable, explains 3.4% of the digital competence variation (R2 =.034). The results show that this model is statistically significant, F(1,209)=7.33, p = .007. Consequently, *Grit* can be considered a significant predictor (B=8.85, SE = 3.27, p=.007) for our study.

Conclusions of Experimental Research

Our research aimed at verifying the effectiveness of the implementation of the *Digital Early Education* program for in-service professional development, by monitoring the instructional-educational impact on the digital competences in the case of early education teachers and educators, competences which are stipulated by the DigCompEdu European framework. Determining the level of digital competences of early childhood education teachers and educators was the first objective of the research in order to establish the performance achieved by the study participants following the participation of the experimental group in the intervention program. The test was carried out using the *SELFIE for TEACHERS* questionnaire, validated in Romanian at the pre-experimental stage of the research.

The second objective of the research was the selection of digital technologies and content tailored to the specific needs of pre-school education, in accordance with the provisions of the Digital Competence Framework for the Education Professional (DigCompEdu). This approach has been valuable in order to design a practical-applicative model that has shaped up the program for in-service professional development *Digital Early Education*, contributing to the improvement of educational practices and implicitly to the streamlining of the teaching process.

On the basis of the information discovered in the pre-experimental stage, both through the questionnaire-based survey and the focus-group discussions, a program for in-service professional development was developed to develop the digital competences of early childhood education teachers and educators in Maramureș County, which is the third formulated objective of our research. This program was approved by the Ministry of Education by ministerial order, and the program piloted in the research will be implemented at national level.

The early education teachers who constituted the experimental group participated in the activities included in the intervention program. The activities had a significant impact on

the participants, capitalizing on the knowledge gained in creating open educational resources adapted to early education. Some of the resources can be found on the blog https://robotieducationali.blogspot.com/, which was set up so that the study participants could access information to complement the knowledge acquired in the activities. This blog has been a valuable digital resource for the participants, as they have found examples of good practice in order to be able to effectively put into practice the digital technologies and resources created by them and our research team.

The last objective of the research study was to analyze the effectiveness of the program for in-service professional development. This objective was achieved by interpreting and comparing the results obtained by the participating teachers and early childhood educators in the pretest and posttest phase. The results obtained, detailed below, confirm the achievement of this objective.

With reference to the experimental group obvious improvements have occurred. Taking into account the fact that, in the pre-experimental stage there were 11 teachers (10.65%) with a digital competence level of A1, in the post-experimental stage this level disappeared for the experimental group, which shows that for this level there were significant increases. Also, for the A2 level we had 75 teachers (72.1%) in the pretest stage and 19 (18.35%) in the post-test stage, which shows that increases have occurred for this level of proficiency as well. Changes were also recorded for B1 level as follows: from 17 teachers (pre-test) to 62 teachers (post-test), and for B2 level, the increase was significant, given that in the pre-test stage we had only one person evaluated at this level, and in the post-test stage the number increased to 17 (16.3%). The most significant progress made in the post-test phase is indicated by the emergence of participants in C1 categories, 4 teachers (3.8%) and C2, 2 teachers (0.9%), who did not exist in the pre-experimental stage.

The obtained results, validate the research question *To what extent does the level of Grit of early childhood education teachers influence the level of their digital competences?* Therefore, it was found that the sample of participants had a fairly high level of *Grit* at the initial stage of the research, which resulted in significant digital competence outcomes. Due to this level, the participating teachers were considered *Gritty*, this aspect being particularly important in the engagement and conscientiousness they showed during the program. Therefore, the statistical analyses showed that there is a significant correlation between *Grit* and digital competences, leading to the transformation of the teaching process. Thus, the teachers were able to understand that "teaching is a dynamic, complex, undoubtedly emergent process because it is more than the sum of its parts" (Catalano, 2024). The results related to the

level of digital competences, were emphasized by the two attributes of *Grit* (passion and perseverance). The significant value of the linear regression, confirms that *Grit* is a predictor of educational and professional success, a result also confirmed by F.D. Fernández Martín and collaborators (2020).

Our results are also supported by J. A. Fraillon et al, (2020) who highlight in their paper the importance of targeted educational interventions aimed at developing digital competences, as the effective use of digital technologies is an essential competence for an increasingly digitized society. In line with this study, our results confirm that such interventions can produce significant changes pertaining to digital competences, even in shorter periods of time. Moreover, the results demonstrate that the intervention program improved the instructional practices of the teachers included in the experimental group, supporting that teachers use digital technologies effectively in their teaching.

On the basis of the obtained results, we conclude that the specific hypotheses have been confirmed, and this contention is supported by the statistical results. The increase of digital competences in the experimental group confirms that the intervention program was an effective one, being adapted to the needs of early childhood education teachers.

The accreditation of the intervention program Digital Early Education by MEC representatives (number 3532/12.03.2025) confirms its effectiveness. As a result of this accreditation, the educational practices will be expanded nationwide, early education teachers having the opportunity to obtain 30 transferable credits, after completing 90 hours, both synchronously and asynchronously.

Although the research hypotheses have been confirmed and the intervention program has proven to be very successful, there have been, nevertheless, some limitations.

One of the limitations we have faced is connected to the sample of participants. Although it was a representative one, in the initial stage some additional discussions and meetings with the representatives of the methodological centers were necessary to determine participants' active involvement. Another limiting aspect is the exclusive selection of the Maramureș county sample, which does not allow a generalization of the results at national teacher population level. Since the teachers' participation in the study was voluntary and consensual, some researchers might consider that teachers who expressed their willingness to participate in the study are more passionate about technology than those who did not participate.

On the other hand, the number of respondents who were involved in filling in the *SELFIE for TEACHERS* questionnaire for the purpose of linguistic validation can be considered to be quite small.

Additionally, although the locations chosen in the study had the necessary infrastructure for the implementation of the *Digital Early Education* Intervention Program, in some of them the internet was not always functional and the audio-video equipment was not always sufficient, which sometimes made it difficult to carry out the activities in optimal conditions

We consider that our attempt to prove the effectiveness and the need for professional training programs contributing to early education teachers' development of digital competences proved to be successful, having provided all practitioners at this level to participate in training sessions in the digital environment. We believe that through this dissertation we have succeeded in making a significant contribution to the field of early childhood education by providing opportunities for early childhood practitioners to participate in digital literacy training.

The doctoral dissertation *The Development and Enhancement of Pre-school Education Teachers' Digital Competences through the Elaboration and Implementation of a National In-service Training Program* supports the contention that participation in in-service training programs has a particularly important role in the development of digital competences of early education teachers and educators, contributing to the optimization of the didactic process through the effective integration of digital technologies.

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