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The Problems of Contemporary Education

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The Problems of Contemporary Education

Pedagogical Scaffolding Through Online Quests and Its Influence on Students' Learning Motivation in the Context of Educational Digitalization

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Abstract

The goal of modern education is to create conditions for the personal growth of each learner, enabling them to acquire and improve professional competencies and skills. In this context, quest-based (online quest-based) teaching technology deserves special attention as a form of pedagogical scaffolding within the higher education system. The aim of this study was to evaluate the applicability of online quests as a pedagogical scaffolding technology for enhancing achievement motivation among students within a single university setting. The study explores the essence of two core concepts: "online quest" and "pedagogical scaffolding." The primary method employed was a comprehensive pedagogical experiment conducted during the second semester of the 2023–2024 academic year. The experiment included two experimental groups of 62 and two control groups of 58 students, accounting 120 participants in total. The experiment unfolded through several well-structured phases, including preparatory activities, baseline assessments, the implementation of a long-term online quest via the Moodle system, and follow-up data analysis using methods of mathematical statistics. The results revealed a significant increase in student engagement, critical thinking, and independent learning among participants in the experimental groups, as well as confirming the research hypothesis that the use of online quests as a scaffolding technology effectively enhances students' achievement motivational levels.

Keywords: online quest, educational quest, pedagogical scaffolding, higher education, teaching technology, achievement motivation.

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1. Introduction

The integration of innovative technologies, methodologies, formats, and tools for teaching, upbringing, and youth development is a necessary condition for modern educational environments. Diversifying educational processes in higher education institutions fosters active cognitive engagement, enhances students' motivation to learn, and develops creativity, communication, and information-search skills. University graduates today must not only possess certain knowledge and skills but also demonstrate imagination, critical thinking, independence, and the ability to engage in lifelong learning (Kicherova, Efimova, 2016).

New standards emphasizing competency-based and learner-centered approaches require the adoption of novel educational technologies. Effective educational technologies should meet the following criteria: high cognitive activity and effectiveness, interactivity and collaboration, integrativeness, reliance on self-analysis (reflection), and active use of Internet resources and educational platforms. Among these, quest-based (online quest-based) learning technologies stand out, especially as online education grows as a proportion of the overall educational process.

To explore the issue outlined in the article's title, it is essential to clarify the essence of the two key concepts: "online quest" and "pedagogical scaffolding".

Scientists view online quests as a distinct category of educational projects, or online projects (Kaivola et al., 2012; Larionova, 2020; Pryadilnikova, 2015; Klimova, 2016). These are conceptualized as problem-solving tasks with elements of role-playing, utilizing Internet resources for their completion (Goltsova, Protsenko, 2021), or as student-centered technologies designed to immerse learners in an educational process that fosters critical thinking (Petrova, 2014). Researchers have found that online quests are among the most complex information and communication technologies, as they allow for solving comprehensive learning tasks while developing various linguistic, research skills, and professional qualities (Miller, 2015; Khupina, 2016; Bezrodnykh, 2016, Matveeva, 2014).

Researchers emphasize that online quests are structured learning frameworks that incorporate references to critical Internet resources and authentic tasks. These tasks motivate students to engage with research problems that have ambiguous outcomes, enhancing their ability to work both individually and collaboratively in searching for information and transforming it into more complex solutions at the final stages (Maddux, Cummings, 2007).

An online quest is essentially a type of web page, which can be created using traditional web editors or software such as Microsoft Office, often with the assistance of video tutorials on free educational websites (Ostapovich, Miller, 2016). The essence of pedagogical scaffolding technology lies in educators guiding students toward discovering new knowledge by employing cognitive or exploratory tasks and instructions that build on their prior experiences. This support can take various forms, such as flowcharts, guiding questions, or recommendations (Mirontseva et al., 2023).

Modern scholars regard scaffolding as a distinct form of instruction that fosters collaboration between educators and students in solving academic tasks (Hmelo-Silver et al., 2007). A hallmark of scaffolding strategies is "fading help," where the level of assistance from the educator is high at the start of learning but diminishes significantly or disappears entirely as learners progress (Panadero et al., 2016).

Researchers define scaffolding as a learning process that enables students to acquire specific knowledge and skills with the educator's help (Kuryan, Voronina, 2020). It is a specialized form of guidance during problem-solving tasks, characterized by two key principles: assisting students with tasks they cannot yet handle independently and allowing them to perform tasks that align with their current capabilities (Nguyen, 2022).

Complex topics in this approach are typically divided into smaller subtopics or concepts, with support provided at each stage to facilitate understanding and mastery. New knowledge is built upon prior learning (Van de Pol et al., 2010), creating a psychologically safe environment in which students achieve a higher level of comprehension and skill development than they would without external assistance. Educator support is gradually reduced as it becomes unnecessary (Reiser, 2004).

Scaffolding also helps alleviate negative emotions associated with a lack of confidence, disappointment, or fear of failure (Gašević et al., 2015). Rooted in constructivist philosophy, this approach considers the learner's perception, experience, and active engagement in the educational process. The educator's role is to foster the student's autonomy in constructing their learning experiences (Doo et al., 2020; Puntambekar, Hubscher, 2005; Walqui, 2006).

Researchers emphasize the importance of creating a psychologically safe environment to enhance students' confidence in achieving success (Bykovskikh, 2022). Tasks are initially designed to be manageable with minimal or no assistance, helping students achieve quick success, reducing frustration, and fostering long-term motivation (Pea, 2004).

T. March was among the first to define online quests as a form of pedagogical scaffolding that uses Internet resources for specific tasks, encourages curiosity, and motivates students to explore key problems, acquire new knowledge, and engage in group work (March, 2007). This approach aids in structuring information, understanding complex concepts, and developing skills to apply knowledge in practice. Well-designed online quests inspire students to expand their knowledge and use it creatively in more advanced tasks.

Thus, we have reached the following conclusions: the primary goal of an educational online quest is learning, which includes acquiring new knowledge, consolidating existing knowledge, and developing Internet literacy and other subject-specific skills. Scaffolding technology, in turn, involves the methodological support of students during the learning process, particularly when studying new concepts. It creates conditions to improve student performance on complex tasks. Once students have familiarized themselves with new information and show signs of understanding, the teacher gradually reduces the use of scaffolding, minimizing its influence to foster further independent and self-regulated learning.

Online quests, as a form of pedagogical scaffolding, involve using links to key Internet resources required to complete specific tasks, encouraging curiosity, and motivating learners to explore key problems, acquire new knowledge, and participate in group work.

Based on the above, the purpose of this article was to analyze the potential of online quests as a scaffolding technology for enhancing achievement motivation.

Research Hypothesis: The use of online quests as a scaffolding technology significantly increases the level of achievement motivation.

2. Methods

To achieve the stated goal, the authors employed several methods, including an analysis of psychological-pedagogical and scientific-methodological literature, as well as a pedagogical experiment.

The analysis of psychological-pedagogical and scientific-methodological literature helped clarify the essence of two core concepts: "online quest" and "pedagogical scaffolding."

The primary research method was a pedagogical experiment conducted during the second semester of the 2023-2024 academic year. The study involved students enrolled in humanities disciplines, including education, philology, and social sciences. These students were selected from pre-existing academic groups from the Peoples' Friendship University of Russia (RUDN University). Participants were randomly assigned to either the experimental group (EG) or the control group (CG) to minimize selection bias. This random allocation was performed within each academic cohort to ensure comparable baseline characteristics across the groups.

Two experimental groups (EG) comprising 62 students in total participated in the experiment to test the effectiveness of online quests as a scaffolding technology for enhancing achievement motivation. Additionally, two control groups (CG) with a total of 58 students were included to assess motivation for achievement.

The experiment was conducted in stages (Table 1).

Table 1. Stages of the Pedagogical Experiment

Stage	Participants	Description of Procedures
Preparatory	Authors	Determining the relevance, goal, objectives, object, and subject of the experiment; developing a long-term educational online quest using Google Sites for experimental verification; selecting participants.
Baseline Experiment 1	62 students of Experimental Group, 58 students of Control Group	Assessing the empirical indicators of achievement motivation among CG and EG students at the start of the experiment.

Formative	62 students of Experimental Group	Conducting the long-term educational online quest with EG students during the period of studying the topic.
Baseline Experiment 2	62 students of Experimental Group, 58 students of Control Group	Collecting empirical indicators of achievement motivation among CG and EG students after the educational online quest in the EG.

The formative experiment was conducted during the teaching of specialized disciplines under natural learning conditions using the Moodle system. Moodle's ability to support a large number of users simultaneously enabled the seamless participation of all 62 EG students from different academic groups in the research.

The assessment of empirical indicators of achievement motivation was carried out using specially selected testing methods, including:

– V.K. Gerbachevsky's questionnaire "Assessment of Ambition Levels" (Nguyen, 2022), which identified the place of cognitive motivation in the overall motivational structure of students. It contains 10 closed-ended items designed to identify the student's leading motivational drivers (e.g., cognitive interest, career focus, or social approval). Respondents rated their agreement on a 5-point Likert scale.

– A. Rean's questionnaire "Motivation for Success and Fear of Failure" (Van de Pol et al., 2010). It consists of 20 items divided into two subscales: 10 questions assess motivation for success, and 10 measure fear of failure. Each item is rated on a 4-point Likert scale, ranging from "strongly disagree" to "strongly agree." The tool identifies whether a student is primarily driven by the pursuit of success or by the avoidance of failure.

Subsequent data analysis from the pedagogical experiment was performed using methods of mathematical statistics. The aim was to identify differences in the distribution of a specific trait (achievement motivation) when comparing two empirical distributions. For this purpose, Pearson's chi-squared test (χ^2) was employed. The measurement scale consisted of two categories ("high level" and "not high level"), resulting in one degree of freedom ($v = 1$).

Statistical Hypotheses:

– H_0: The empirical distributions of EG and CG students by levels of achievement motivation do not differ after the experiment.

– H_1: The empirical distributions of EG and CG students by levels of achievement motivation differ after the experiment.

3. Results

The results of our study (see Table 2) indicate that conducting a long-term educational online quest positively impacted the achievement motivation of students in the experimental group (EG).

Table 2. Dynamics of Changes in Achievement Motivation Indicators in CG and EG (% with a high level)

Testing Method	CG (58)			EG (62)		
	Start of Exp.	End of Exp.	Change	Start of Exp.	End of Exp.	Change
Place of cognitive motivation in the system (V. Gerbachevsky's method)	12.1	17.2	+5.1	14.5	46.8	+32.3
Success motivation and avoidance of failure (A. Rean's questionnaire)	17.2	20.7	+3.5	17.7	51.6	+33.9

Prior to the formative experiment, an analysis of achievement motivation levels in the EG and CG was conducted, revealing that the groups had nearly identical baseline indicators. Specifically, cognitive motivation was a leading factor for 12.1 % (7 students) of the CG and 14.5 %

(9 students) of the EG. Similarly, a high level of success motivation was observed in 17.2 % (10 students) of the CG and 17.7 % (11 students) of the EG.

A comparison of achievement motivation indicators before and after the experiment demonstrates that while the cognitive motivation of CG students increased slightly, the change was not significant, as was the case with their success-oriented motivation.

In contrast, after the online quest, cognitive motivation became a leading factor for 46.8 % (29 students) of the EG, and 58.1 % of EG students showed a success-oriented motivational framework.

Thus, as shown in Table 2, the pedagogical effect of the online quest is 32.3 % and 33.9 % in the EG, compared to 5.1 % and 3.5 % in the CG, proving the pedagogical effectiveness of the online quest. This difference occurred because of the fact that the structure of the online quest emphasized goal-oriented progression, frequent achievement feedback, and completion of visible milestones, which naturally aligns with success-driven motives. In contrast, cognitive motivation, which is often linked to intrinsic interest and curiosity, may require longer-term exposure or more open-ended learning scenarios to develop more fully.

Results of the statistical analysis are demonstrated in Table 3.

Table 3. Calculations of the χ^2 Criterion for CG and EG

Testing Method	Start of Exp.			End of Exp.		
	CG (58)	EG (62)	χ2	CG (58)	EG (62)	χ2
Place of cognitive motivation in the system (V. Gerbachevsky's method)	12,1	14,5	1,108	17,2	46,8	42,23
Success motivation and avoidance of failure (A. Rean's questionnaire)	17,2	17,7	0,214	20,7	51,6	56,67

Based on the χ^2 distribution table for a significance level of $\alpha = 0.05$ and degree of freedom $v = 1$, the critical value is $\chi^2 = 3.841$.

Before the pedagogical experiment, the calculated χ^2 values were less than the critical value (1.108 < 3.841;0.214 < 3.8411.108 < 3.841; 0.214 < 3.8411.108 < 3.841;0.214 < 3.841), meaning they did not fall within the critical region. This indicates that at the start of the experiment, the CG and EG did not differ significantly in their achievement motivation levels.

The χ^2 calculations for CG and EG after the pedagogical experiment revealed that $\chi 2 > \chi 2crit$ (42.23 > 3.841; 56.67 > 3.841). This provides a basis to reject hypothesis H_0 and accept H_1, confirming that these samples exhibit statistically significant differences.

Thus, it can be concluded that the hypothesis proposed at the start of the experiment was confirmed.

4. Discussion

The authors emphasize that integrating online quest technology into the professional training process offers several advantages: increasing student engagement with the subject, enhancing learning motivation, utilizing various types of information (textual, graphical, audio, video, etc.), clearly presenting diverse situational tasks, fostering creative thinking and problem-solving skills, and developing students' information literacy (Wagner et al., 2024; Babina, Utusikov, 2024).

Conducting online quests at universities prepares students for a comfortable life in an information society. By incorporating online quest technologies into the educational process, students developed qualities such as enhanced thinking skills (creative, intuitive, theoretical, etc.), improved communication abilities, aesthetic sensibilities, the ability to make optimal decisions or propose solutions in complex situations, and proficiency in processing information (Akhmetov et al., 2024; Rybakova et al., 2024).

The implementation of online quest technologies in education deepens interdisciplinary connections through the use of modern information processing tools (Andreeva, Pronina, 2024). It boosts students' motivation through computer visualization of educational materials, the inclusion of game-like scenarios, and flexible modes of learning activity. Additionally,

it improves the efficiency and quality of education by leveraging Internet services. Online access tools have added entirely new dimensions to e-learning (Matveeva, 2014).

It is worth noting that preparing an online quest requires a high level of informational competence from educators. Developing an informational online quest is a labor-intensive process; however, it allows educators to refine their professional skills (Ginzburg et al., 2024). The resulting online quest becomes a highly specialized and effective visual trainer for professional development across a wide range of fields (Miller, 2015). Furthermore, online quests integrate seamlessly with distance learning systems, particularly Moodle, and are compatible with mobile devices (Bezrodnykh, 2016). It is also worth noting that while both types of motivation improved significantly, the baseline levels of success motivation were slightly higher than those of cognitive motivation, which may have made them more responsive to structured interventions like the quest format.

The study results highlight that the core idea of using online quests as a pedagogical scaffolding technology is to create a situation of success during lessons, which scaffolding technology supports most effectively. A situation of success helps students overcome learning difficulties, such as shyness, insecurity, or fear of making mistakes and being ridiculed by peers (Medeshova et al., 2024; Mukhametkairov et al., 2024). Researchers note that from a pedagogical perspective, a situation of success involves purposeful and organized efforts by educators and families to create conditions enabling individuals or groups to achieve significant results (Ostapovich, Miller, 2016). Success is realized when the student perceives their outcome as a personal achievement.

According to our observations, a situation of success during a lesson is fostered by the following factors: a friendly atmosphere throughout the session (using the "emotional reinforcement" technique), "preempting" a successful outcome (employing the "personal exceptionalism" method), strong motivation for proposed activities, subtle assistance (hints, suggestions, guidance), brief expressive interventions (the "pedagogical suggestion" method), and a focused approach (using motivational phrases such as "Let's get started!" or "On to the task!"). Additionally, formative assessment – evaluating students' achievements continuously throughout the learning process rather than just at the end – plays a significant role.

Researchers also highlight that the most effective educational technologies for creating a situation of success, when applying scaffolding, include:

– Interactive learning technologies (such as online quests),

– Cooperative learning (e.g., pair or group work involving dialogue and synthesis of opinions),

– Collective-group learning (e.g., techniques like "microphone," sentence completion, circle discussions, brainstorming, and mosaic activities),

– Situational modeling technologies (e.g., role-playing, simulations, and imitation games),

– Case method (e.g., situation analysis),

– Discussion processing technologies (e.g., continuous opinion scales or chains) (Mirontseva et al., 2023).

While the findings of this study support the effectiveness of online quests as a pedagogical scaffolding method, it is important to consider several limitations of this approach. Online quest-based learning may not be equally effective for all students, particularly for those with low digital literacy, limited self-regulation skills, or high levels of anxiety in open-ended tasks. The method also relies heavily on well-developed infrastructure, instructor digital competence, and time-consuming preparation, which may not be feasible in all educational settings. Furthermore, some students may respond better to other scaffolding formats, such as face-to-face guided discussions, project-based learning, or cooperative assignments with stronger social support elements. Therefore, while online quests offer significant advantages, they should be used as part of a broader toolkit of scaffolding strategies, adapted to individual student needs and learning environments.

This study has several limitations that should be acknowledged. First, the research was conducted within a single university, which limits the generalizability of the findings to broader higher education contexts. Second, the sampling was non-probabilistic, based on pre-existing academic groups rather than random selection, which may introduce selection bias. Third, although standardized instruments were used to assess achievement motivation, the validity of these tools was not independently tested within the context of this specific study, which may affect the reliability of the conclusions.

A promising area for future research is the analysis of the potential of online quests as a scaffolding technology to improve learning outcomes.

5. Conclusion

Information technologies in the educational process of preparing future specialists serve as a powerful stimulus that enhances students' cognitive activity, improves the quality of knowledge, and fosters the development of independent learning skills. The use of online quests increases the informational competence of both educators and students, introduces them to modern Internet services, cultivates informational literacy, promotes critical thinking, and develops the ability to find holistic solutions to problems.

Online quests integrate various didactic techniques into a single, cohesive learning activity. They enhance students' cognitive skills, contribute to the development of communicative competence in a foreign language within a professional context, and foster critical thinking. Pedagogical scaffolding, as a means of guiding cognitive activity, plays a crucial role in this process since knowledge cannot simply be transferred in a ready-made form. The learning process creates a favorable environment for students to build and expand their knowledge independently. Students improve their skills in interpreting information, analyzing, and evaluating different perspectives on specific issues.

As a type of pedagogical scaffolding, online quests also help establish conditions for the development and self-realization of students, enabling them to achieve their full potential.

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Identifying Key Predictors of Academic Performance in the Context of Higher Education Digitalization: A Regression Analysis with Regularized Models

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Abstract

This paper presents the results of a statistical analysis of educational disciplines based on data regarding various types of student activities, utilizing regression models with L1 regularization under the condition that coefficients remain positive. With the digital transformation of higher education and the integration of electronic educational technologies into traditional teaching methods, there is a growing need for an objective performance assessment of various educational components. A statistical analysis can be used to identify key factors influencing student performance, including activity in the electronic educational environment, attendance in classroom sessions, and results of interim assessments. The study was conducted using data from two academic disciplines that differ in their level of electronic support. The results confirmed two main hypotheses: 1) In disciplines with richer electronic content, student activity in the digital environment becomes a significant predictor of academic performance. 2) Disciplines where educational activity significantly influences learning outcomes receive higher ratings in student surveys. The proposed statistical analysis toolkit has dual practical value. On one hand, it provides educational institutions with a mechanism to monitor pedagogical activities. This mechanism serves as an empirical basis for developing intelligent decision-support systems within the educational process. On the other hand, based on the constructed models, personalized recommendations can be generated for students regarding optimal strategies for mastering a specific course.

Keywords: regression models, statistical analysis, performance predictors, electronic educational environment

1. Introduction

Contemporary higher education is undergoing a significant transformation due to the rapid digitalization of every aspect of the educational process. The adoption of hybrid learning

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approaches that combine conventional teaching practices with modern electronic tools has been expedited by recent worldwide disruptions. Today, most universities are embracing technological platforms that offer educational stability and flexibility, allowing educators to monitor, assess, and improve student engagement and academic performance.

Modern electronic educational environments collect substantial amounts of data on various aspects of student activity, including attendance at virtual and physical classes, assignment completion, discussion participation, and interim and final assessment results. These data represent a valuable informational resource for identifying key academic performance indicators. It enables timely adjustments to the educational process based on the collected information.

Traditional face-to-face learning also generates substantial volumes of both structured and unstructured information, including attendance logs, seminar work grades, lecturer observations, and written assignments resuts. However, without the aid of modern analytical tools, these data are often underutilized for making management decisions in the educational process. In this context, mathematical methods that can identify the most significant predictors of academic success are particularly valuable.

Regression (Bastos et al., 2024; Olsen et al., 2020) is a widely used machine learning method that approximates a set of labeled training data with a specific function. Although more advanced methods, such as neural networks, can handle complex dependencies, regression remains relevant due to its ability to provide interpretable solutions, foster trust in the results, and offer a range of statistically sound tools for assessing feature and coefficient significance. Additionally, regression can be used with smaller datasets, making it particularly suitable for analyzing educational data that may be limited by class sizes.

Determining the optimal set of independent variables is a critical challenge in developing an effective regression model. This is particularly important in educational analytics, where selecting the right features can not only improve prediction accuracy but also help identify the most significant factors that influence student outcomes.

This study presents a statistical analysis of educational disciplines using student activity data. The analysis employs regression models with L1 regularization with the constraint that the coefficients must remain positive. This approach can be used to identify crucial factors influencing academic performance and assess the effectiveness of various components of the educational process, such as online courses and traditional teaching methods.

The primary objective of this research is to determine the key factors that significantly impact student performance using regression analysis. Additionally, this study aims to evaluate the correlation between the importance of these factors and student satisfaction with the overall quality of the educational process.

The study tests two main hypotheses: (1) Activity in online courses will have a significant impact on performance in disciplines with a strong online component but minimal effect in those with little electronic support. (2) Disciplines where student activity significantly influences learning outcomes receive higher ratings in student surveys.

2. Literature Review

The development of objective assessments as a key indicator of competency acquisition and the identification of factors that influence academic performance are subjects of active study in the literature (Vasilev et al., 2024, Vlachopoulos, Makri, 2024).

One area of research focuses on the problem of qualitatively assessing student performance. For example, in (Eyad, 2021), the author emphasizes the importance of clear criteria, feedback, and adaptability in assessment methods. Study (Dinh, Nguyen, 2015) analyzes factors that influence the quality of educational assessment, including teacher preparation, methodologies, and assessment tools. The study found that subjectivity, inadequate teacher training, and inappropriate criteria reduce the reliability of assessments. Research (Hasanah, 2023) explores factors that influence the evaluation process in higher education from the perspective of lecturers, using qualitative methods such as interviews with lecturers. It was revealed that a lack of time and high academic workloads negatively affect assessment quality. Study (Day et al., 2018) discusses challenges in higher education assessment and potential solutions. The main issues identified include educational massification, student diversity, and pressure on faculty.

A separate group of studies evaluates factors influencing final grades based on statistical data. Authors (Kristiyandaru et al., 2023) investigate key factors affecting assessment systems

within mandatory physical education courses at Indonesian universities. The dominant factors identified include infrastructure (87 %), teacher qualifications (79 %), and student motivation (72 %). The study outlines major issues in the assessment system, including subjectivity in evaluating practical skills and insufficient qualifications of faculty in modern assessment methods.

Study (Owuor et al., 2021) discusses factors influencing student performance, such as motivation, knowledge level, psychological state, and teaching methods. The research is based on a case analysis and reveals that both external conditions (e.g., stress) and internal factors (e.g., self-organization) play crucial roles. Recommendations include adapting assessment methods to meet the individual needs of students.

The authors (Tadesse, Gidey, 2015) explore various factors affecting students' academic outcomes, including socio-economic status, access to resources, and teaching quality. The analysis indicates that inequality in educational opportunities significantly impacts performance. Measures are proposed to reduce these barriers, including support programs and inclusive teaching methods.

The paper (Arbër et al., 2025) examines the use of machine learning techniques for predicting student performance based on socio-economic, demographic, and educational data such as age, marital status, initial qualifications, and average grades from a previous course.

While some studies use statistical methods to identify factors affecting performance, there is a notable lack of detailed analysis regarding student activity throughout the semester and its influence on final grades. Specifically, there is no analysis of students' digital footprints as a comprehensive data source for the learning process. Therefore, there is a need to develop tools based on modern data analysis and machine learning methods to objectively assess the factors affecting student performance, ultimately leading to personalized recommendations for all participants in the educational process.

3. Discussion and results

Lasso Method

To analyze the impact of various educational activities on student performance, the Lasso method (Least Absolute Shrinkage and Selection Operator) was chosen. This method effectively identifies the most significant predictors even with a small sample size (Yamasari et al., 2021; Bouihi et al., 2024; Yoon, Kim, 2023). Unlike traditional linear regression, Lasso employs L1 regularization, enabling sparse solutions by effectively selecting features and zeroing some coefficients. This study assumes that all regression parameters are positive since the features considered are different types of student activities, which cannot negatively affect their performance. The classical approach to solving this problem can be formulated as a linear Lagrangian form, which, considering the imposed constraint, takes the following shape:

$$\sum_{i=1}^{n}\left(y_i-\sum_{j=0}^{p}x_{ij}\beta_j\right)^2+\lambda\|\beta\|_1\to\min,$$
$$\beta\geq 0. \qquad (1)$$

where λ is the regularization parameter;

x is the matrix of explanatory variables (features), with the first column consisting of ones;

y is the vector of dependent variable values;

β are the regression coefficients;

n is the number of observations;

p is the number of features.

To solve problem (1), the built-in Lasso method from the Python programming language was used with the parameter positive = True to ensure that the parameter estimates were positive. The regularization parameter was adjusted experimentally for each model.

This study also explored another approach for estimating regression parameters, based on solving a reformulated conditional optimization problem (Gribanova, 2022; Gribanova, 2020):

$$g(\beta) = \|\beta\|_1 \to \min,$$
$$\sum_{i=1}^{n}\left(y_i - \sum_{j=0}^{p} x_{ij}\beta_j \right)^2 = y^*,$$
$$\beta \geq 0. \quad (2)$$

where y^* is the target value.

To solve problem (2), an algorithm for solving the inverse single-point problem (Gribanova, 2022; Gribanova, 2020) was used, which was modified to account for the positivity constraint: after adjusting the values of the arguments, a check is performed; if the coefficient obtained in a particular iteration is negative, it is set to zero. The algorithm was implemented in Python.

One advantage of L1 regularization is that it enables parameter estimation even when there are more features than observations and in cases where highly correlated features are considered. Thus, methods (1) and (2) can be applied with a limited amount of input data while selecting significant features.

Experiments

To identify key factors influencing academic performance, two disciplines were examined: Economic Analysis and Computational Technologies.

Data were collected based on students' educational activities, which can be roughly categorized into five groups:

1. Student performance data from the previous period: Average grade at the time of studying the discipline (avgGrade).
2. Evaluation of student performance conducted by the lecturer during interim assessments regarding the discipline for the semester. Two interim assessments are conducted during the semester: First and second checkpoints, where the instructor evaluates students' current work, such as attendance at lectures and results from practical and laboratory work:

– Score for the first checkpoint (scoreCP1)

– Score for the second checkpoint (scoreCP2)

3. Information on student engagement with the electronic course in Moodle, expressed through their activity (total number of actions in the electronic course) and time spent in the course. Activity was categorized into three intervals relative to the interim assessment:

– Activity before the first checkpoint (activityBeforeCP1);

– Activity between the first and second checkpoints (activityCP1toCP2);

– Activity after the second checkpoint (activityAfterCP2);

– Time spent in the electronic course in minutes (timeInCourse).

4. Attendance rate for in-person lectures, expressed as a percentage of the total number (attendanceRate).
5. Final grade based on performance in the studied discipline (finalGrade).

The study focused on one group of students, resulting in a total of 22 observations. Figures 1 and 2 present the correlation matrices for two disciplines.

Furthermore, the content of the online course for each discipline was examined. The online course for Economic Analysis is actively used in the educational process and includes 13 different types of elements, totaling 163 items. In contrast, the online course for Computational Technologies consists of 4 types of elements, amounting to 12 items in total.

During the research, two hypotheses were tested.

Hypothesis 1: Activity in the online course will have a more significant impact on academic performance for the discipline with a richer content offering.

Hypothesis 2: The academic discipline in which student engagement has a more substantial effect on their final grades will receive higher ratings in student satisfaction surveys. This is because students tend to rate courses more positively when their active participation and involvement directly translate into better academic outcomes, creating a sense of fair evaluation of their efforts and predictability in the educational process.

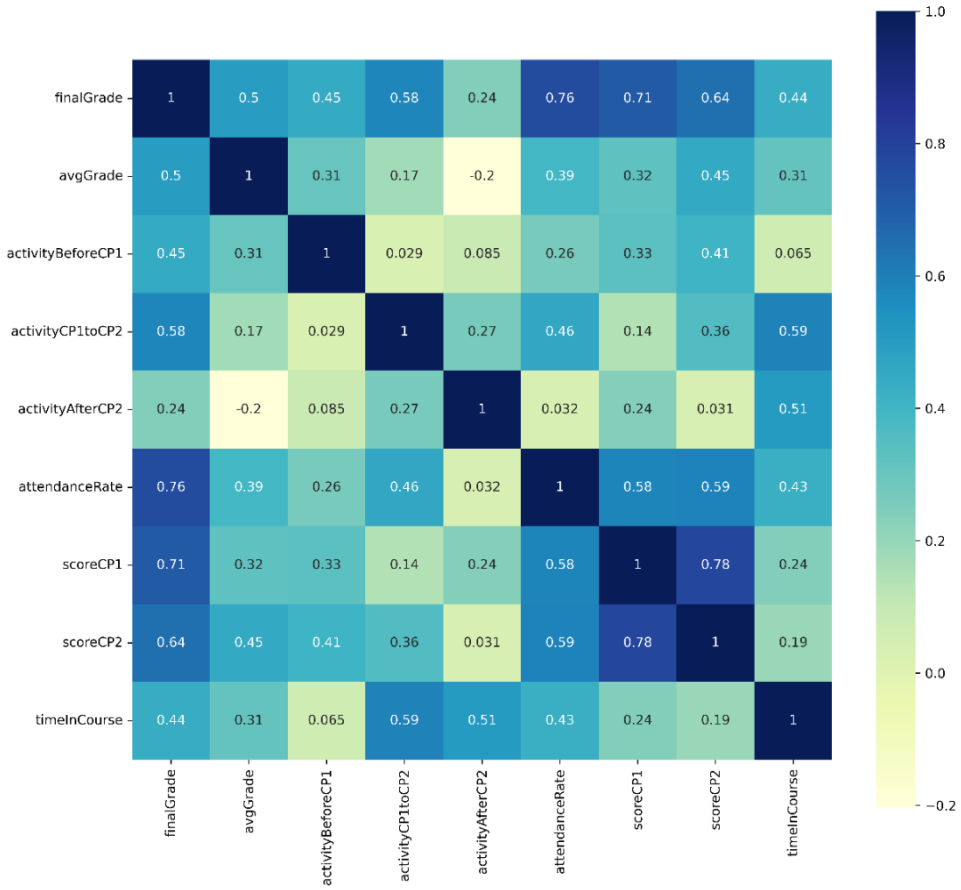

Fig. 1. Correlation Matrix for the Economic Analysis discipline

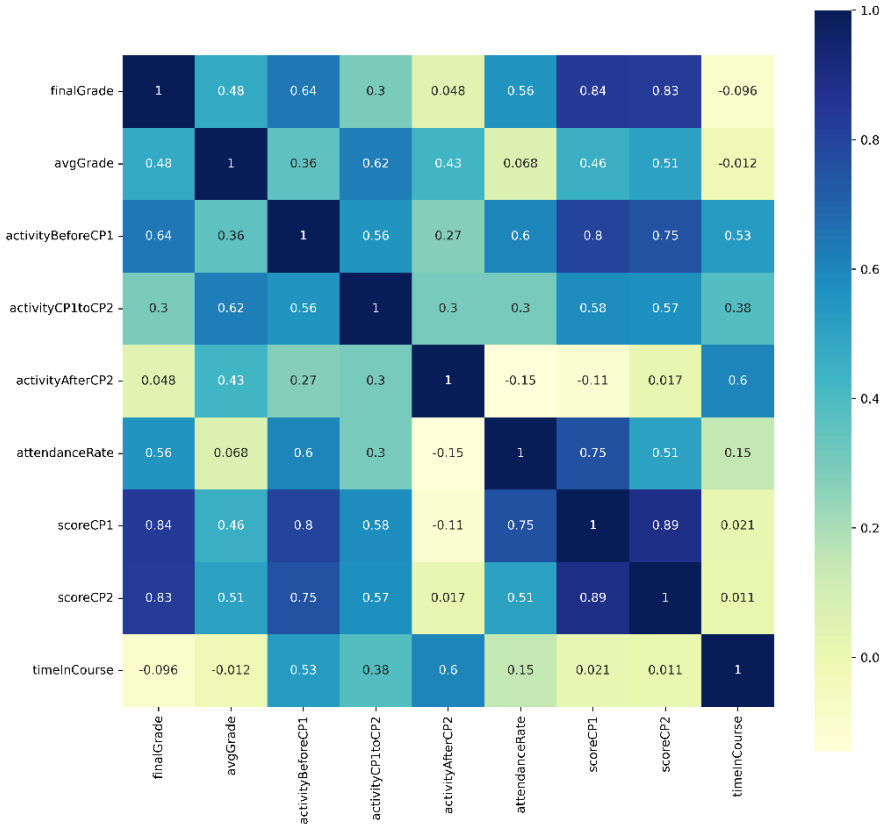

Fig. 2. Correlation Matrix for the Computational Technologies discipline

For modeling purposes, finalGrade serves as the dependent variable, while avgGrade, activityBeforeCP1, activityCP1toCP2, activityAfterCP2, attendanceRate, scoreCP1, scoreCP2, timeInCourse are independent variables.

Two types of regression models were considered: those with constant and decreasing marginal effects.

Linear regression is characterized by a constant marginal effect and unlimited growth of the dependent variable, making it optimal for modeling processes with a steady rate of change. In contrast, nonlinear models with saturation, particularly logarithmic and power functions, feature decreasing marginal effects and asymptotic behavior at high values of the feature, allowing for the modeling of situations where the rate of change in the dependent variable decreases as it approaches a saturation limit.

For the linear model, methods (1) and (2) yielded the same selection of factors, whereas results differed for the nonlinear model. Therefore, based on data from the Economic Analysis discipline, the following models were examined:

1. Model 1 – Linear Model;
2. Model 2-1 – Logarithmic Model, with parameter estimation using method (1);
3. Model 2-2 – Logarithmic Model, with parameter estimation using method (2).

The results of these calculations are presented in Tables 1 and 2. For Model 2-2, the step size αused during parameter tuning is also provided. Model evaluation metrics included significance indicators (F-statistic value and p-value), Mean Squared Error (MSE), Mean Absolute Error (MAE), R-squared (R^2), and information criteria that characterize the balance between model accuracy and complexity: Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC).

Table 1. Regression results (dependent variable – finalGrade, standard errors are shown in parentheses)

Variables	**Model 1**	**Model 2-1**	**Model 2-2**
avgGrade	0.14	1.84	–
activityBeforeCP1	0.15^{λ}	–	–
activityCP1toCP2	0.29^{**}	–	–
activityAfterCP2	0.06	0.08	–
attendanceRate	0.23^{λ}	0.6^{λ}	0.43
scoreCP1	0.31^{*}	1.33^{*}	1.55^{**}
scoreCP2	–	–	–
timeInCourse	–	–	0.01

Notes: *** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$; $^{\lambda}$ $p < 0.1$.

Table 2. Comparison of prediction measures of different models

Method	MSE	MAE	R^2	AIC	BIC	F-statistic	p-value
Model 1	0.1	0.27	0.86	26.46	34.41	15.6	$\mathbf{7.02 \cdot 10^{-6}}$
Model 2-1,	0.21	0.41	0.7	56.44	62.12	10.51	$1.4 \cdot 10^{-4}$
Model 2-2,	0.24	0.46	0.65	55.13	58.53	13.50	$1.8 \cdot 10^{-4}$

Comparing the three models suggests that the linear model is the best option in this case, as it is highly significant and has lower evaluation criteria values: MSE, MAE, R^2, AIC, BIC. Furthermore, this model has more significant coefficients with lower error values. Figure 3 presents the ranking of variables in this model according to their significance. All three types of variables related to online course activity, attendance at in-person lectures, and interim assessments are significant. Thus, it can be concluded that each type of student activity during the semester influences their final grade.

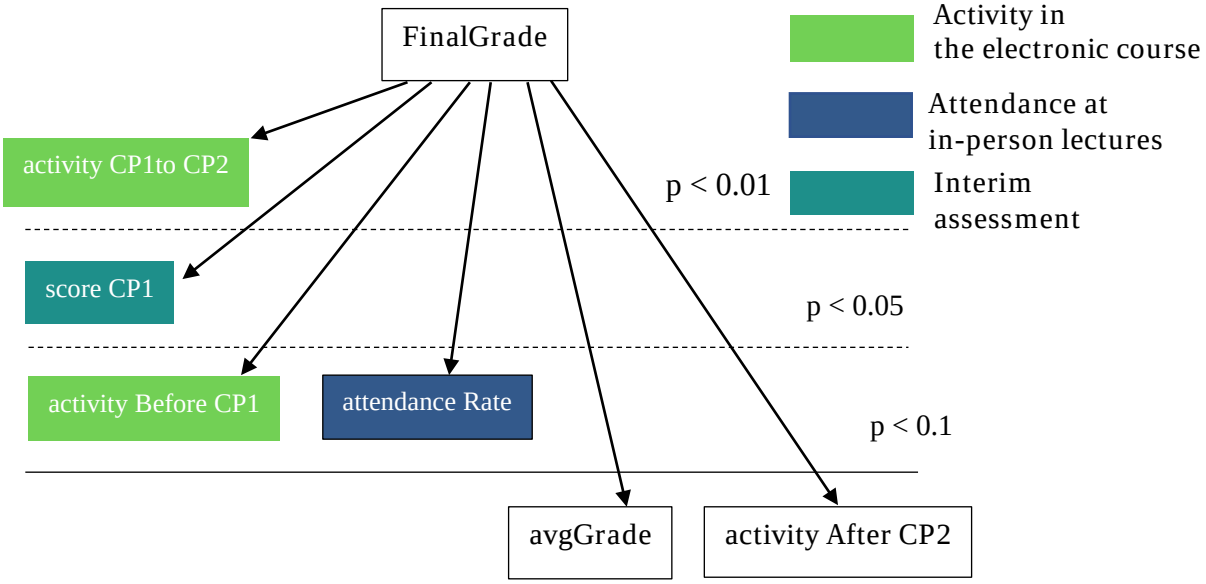

Fig. 3. Feature Importance Tree

Similar calculations were performed for the Computational Technologies discipline. The following models were considered:

1. Model 1 – Linear Model;
2. Model 3-1 – Power Model, with parameter estimation using method (1);
3. Model 3-2 – Power Model, with parameter estimation using method (2).

The results of the calculations are presented in Tables 3 and 4. According to the findings, the power model 3-2, obtained using method (2), showed the highest significance. However, none of the features were significant at the $p < 0.1$ level; in fact, some features had p-values close to 1. The insignificance of all coefficients generally indicates that the variables included in the model do not have a statistically significant impact on the dependent variable within the studied context. The significance level of the regression is also lower than that for the Economic Analysis discipline.

Table 4. Regression results (dependent variable – finalGrade, standard errors are shown in parentheses)

Variables	**Model 1**	**Model 3-1**	**Model 3-2**
avgGrade	0.012		0.05
activityBeforeCP1	–		
activityCP1toCP2	–		
activityAfterCP2	0.06	0.016	
attendanceRate	–	0.028	
scoreCP1	0.32	0.17	0.18
scoreCP2	0.23	0.17	0.17
timeInCourse	–	–	

Notes: *** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$; $^{\lambda}$ $p < 0.1$.

Table 5. Comparison of prediction measures of different models

Model	MSE	MAE	R^2	AIC	BIC	F-statistic	p-value
Model 1	0.10	0.233	0.75	24	26.83	5.88	0.016
Model 3-1,	0.092	0.232	0.77	21.49	24.32	7.16	0.009
Model 3-2,	0.094	0.226	0.77	16.77	19.03	10.99	**0.002**

An analysis of the regression coefficients and their significance levels suggests that in a course rich in educational materials and interactive elements, the nature of the interaction between students and the electronic educational environment becomes a more substantial predictor of their academic performance.

To test the second hypothesis, an anonymous survey was conducted among students to evaluate the conditions, content, and quality of specific disciplines. The evaluation was based on nine criteria:

1. The instructor clearly articulates the goals and objectives of the class and presents the material in a clear and accessible manner while maintaining interest in the subject.
2. The quality and relevance of the knowledge gained in the specified discipline.
3. Organization of the course (learning process).
4. The instructor is objective in assessing students' knowledge.
5. The instructor conducts classes according to the schedule, starting and ending on time.
6. The instructor comments on the results of the tests, quizzes, assignments, term papers, etc.
7. The discipline includes various forms of learning: availability and content of the electronic course (including testing), group work, and project activities.
8. The instructor is friendly and tactful and is capable of building relationships with students.
9. The instructor clearly and consistently defines and adheres to a system of requirements.

Each criterion was assessed using a 5-point scale:

1 – Quality is absent
2 – Quality is rarely present
3 – Quality is partially present
4 – Quality is often present
5 – Quality is almost always present

Eighteen individuals participated in the survey. The results, as illustrated in Figure 4, show that the Economic Analysis discipline received the higher ratings across the various criteria. This outcome supports the second hypothesis, which proposes that the substantial impact of students' activities on their academic performance has a positive effect on their assessment of the quality of the educational process.

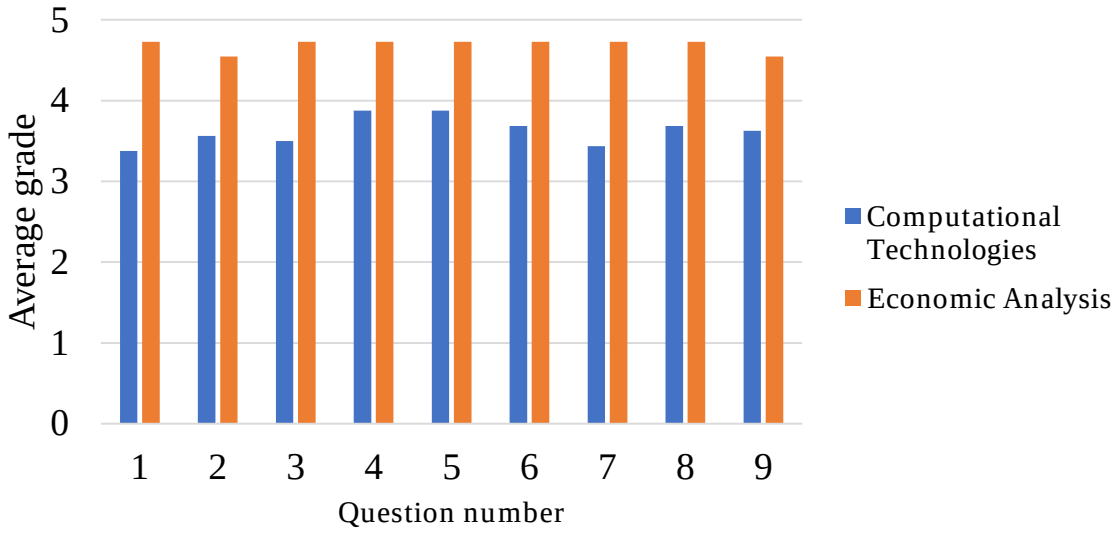

Fig. 4. Results of the Anonymous Survey

This study conducted a statistical analysis of the discipline based on data regarding various student activities throughout the semester to identify the key factors influencing academic performance. The statistical analysis procedure involved the following steps:

1. Gathering data on student activities during the semester.

2. Constructing a Lasso regression model with positive coefficients. For linear models, either method 1 or method 2 can be used. However, for nonlinear models, both methods can be

considered, resulting in different outcomes. Specifically, method 1 produced the best outcome for the logarithmic model, while method 2 was more effective for the power model.

3. Selecting the most significant model from the results. The analysis also included assessing the significance of the coefficients and the regression model. If the coefficients were not significant, it may indicate that students' efforts do not translate into outcomes. Significant coefficients help identify the effectiveness of various learning components, such as online education, in-person classes, and interim assessments.

It is crucial to consider that the level of significance is affected by the number of observations. If there are insufficient observations, the critical significance level may need to be adjusted upward. This study analyzed 22 observations, with a critical significance level set at 0.1. The level can be adjusted based on disciplines used as a sample during the research.

The statistical analysis of educational data presented here enables the creation of a multidimensional "portrait" of the course, reflecting key predictors of the educational process: The effectiveness of integrating digital tools into teaching practices, the relationship between class attendance and students' academic success, the determinism of final educational outcomes based on systematic study activities. The results obtained have dual practical value. On one hand, they provide administrators of educational institution with an objective tool for monitoring and evaluating teaching activities. On the other hand, they serve as an empirical foundation for developing intelligent decision-support systems in the educational process. Based on the constructed models, it is possible to create personalized digital assistants capable of generating adaptive recommendations for students regarding optimal strategies for mastering specific disciplines. For example, if the model identifies a statistically significant impact of activity in an online course on final performance, the intelligent system can generate personalized notifications about the need to intensify engagement with the online components of the course.

4. Conclusion

This study proposes a toolkit for identifying key factors influencing student performance, using regression analysis methods with L1 regularization under the constraint of positive coefficients. A comparative analysis of two regression parameter estimation methods – the classical Lasso and the algorithm for solving the inverse single-point problem – demonstrated their effectiveness when working with limited data samples and highly correlated features.

Experiments conducted on two disciplines (Economic Analysis and Computational Technologies) confirmed the proposed hypotheses. It was established that for the discipline with a more comprehensive online course (163 elements), student activity in the e-learning system is a significant predictor of final performance, while for the subject with minimal online support (12 elements), no such dependence was found.

Survey results from students supported the second hypothesis: the discipline where activity significantly influenced learning outcomes received higher ratings in terms of teaching quality and organization of the educational process. This indicates that creating an educational environment where students' efforts directly reflect on their results is positively perceived by learners and enhances their satisfaction with the educational process.

Statistical analysis of subjects based on student activity represents an effective tool for evaluating educational programs. This approach not only identifies significant factors affecting performance but also assesses the effectiveness of various learning elements, which can serve as a basis for making informed decisions to improve the educational process.

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Enhancing Visual Art Education: Case Study on Exploring the Integration of Digital Tools to Foster Creativity and Innovation of Future Art Educators

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Abstract

Utilizing both qualitative and quantitative methodology, from the grounded theory, this research examined how digital tools can help enhance the creativity of students as future teachers, particularly students of art education and Teaching of fine arts (combined). Research questions focused on determining the prior experiences and perceptions of teachers and students regarding integrating digital tools in art education, specific digital tools used and perceived by students as effective for creativity, digital tools to build future visual arts teachers' creativity and innovation skills as educators, challenges and limitations associated with integrating digital tools in art education. Data were collected through surveys, interviews, and lesson observations. The results from class observations, surveys, and interviews with faculty members revealed that using digital tools for collaboration, and instant feedback alongside creating digital artwork improves certain types of creativity, such as collaborative, innovative, and digital creativity.

Keywords: digital tools, digital creativity, art education, interactivity, collaboration.

1. Introduction

This report is the result of the project "Exploring the Integration of Digital Tools to Foster Creativity", which explored the use of digital technologies in visual arts education. The report presents the results of qualitative and quantitative studies about using digital technologies in the context of the Department of Creative Arts and Art Education at Constantine the Philosopher University in Nitra. Phase I examines students' prior experiences and perceptions of digital technologies and determines missing points that were out of focus in the learning process. Consequently, Phase II explores how these overlooked digital tools can help foster the creativity of students as art teachers. Although artistic endeavors dominantly depend on individual works,

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the collaboration and engagement of students within the instructional framework also have significant importance in art education. The case study provides a comprehensive viewpoint regarding the potentialities and efficacy of diverse digital instruments appropriate for application within the domain of arts education.

The rapid development of digital technologies is transforming ways of communication (Rensburg et al., 2021), tools of creativity (Wang, Li, 2022), and strategies for education (Fernandez, 2019). Numerous studies have tried to explore the significance of digital technologies in art education and creativity. However, a link between pedagogy, creativity, and digital mediums continues to be under-researched.

1.1. Background and Rationale

The advent of digital technologies has revolutionized various sectors, including education. By providing access to a diverse range of digital resources and software, educators can empower learners to experiment, innovate, and express themselves in new and exciting ways (Haleem et al., 2021). This shift is particularly relevant in the context of the Faculty of Education at Constantine the Philosopher University in Nitra, where there is a growing recognition of the need to integrate technology into art curricula to foster creativity. The Department of Creative Arts and Art Education conducted projects regarding creativity in the digital age. One of the projects is "Individual Artistic Expression as Interaction with a Computer" (Project No. 033UKF-4/2012) explores the individual artistic expression of pupils of the 5th and 6th grade of primary schools, which is created by interaction with a computer. It proposes a methodology of art education for creating a digital-electronic image. Another project called "Art Education in Electronic Environment" (Výtvarná výchova v elektronickom prostredí, Project KEGA 2006 3/4021/06) focuses on fostering the creativity of art educators in the digital age.

Despite the obvious benefits of integrating digital tools into art education, there is still a gap in empirical research examining their impact on artist and art teacher creativity in the educational environment. This process requires a thorough analysis of approaches to the use of digital tools and curricula.

This study addresses these gaps by examining the integration of digital tools in the Department of Creative Arts and Arts Education and makes a valuable contribution to best practice in art education in the digital age. The results of this study provide information on aspects to consider when developing curricula using digital technologies. Furthermore, they can serve as a model for institutions seeking to enhance the pedagogical training and professional skills of arts educators in the area of digital technologies. To conclude, since today's social life is directly related to technologies, art education must also develop through their effective use.

1.2. Research objectives

The primary objective of this case study is to explore the potential of digital tools in fostering creativity. This study aims to improve fine arts education practice by examining the current state of integrating digital tools into programs, identifying challenges and opportunities in their implementation, and suggesting effective tools for conducting effective lessons for future art teachers.

Particularly, the study will address the following research questions:

1) What are the prior experiences and perceptions of teachers and students in the department regarding integrating digital tools in art education?

2) What specific digital tools are used and perceived by students as effective for creativity in visual arts education?

3) What digital tools should be incorporated into the educational process to develop future visual arts teachers' creativity and innovation skills as educators?

4) What are the potential challenges and limitations associated with integrating digital tools into art education?

By exploring these questions, the study aims to provide important insights into how to effectively incorporate digital resources into art education, ultimately developing new and engaging learning experiences for students.

2. Literature review

2.1. Importance of Integrating Art Education within the Educational Framework

The current technological era has fundamentally transformed our social lives, including our education through an industry of information (Wang, Lee, 2024; Zhang et al., 2024; Maor et al.,

2024; Xia et al., 2024). Modern technologies in the form of computers (Wang, Lee, 2024), digital applications (Xia et al., 2024), cloud computing, and virtual reality (Zhang et al., 2024) have entered every level of society and affect people's work, and education. The fourth Industrial Revolution has led to an emergency of completely new labor conditions, social welfare sectors, creation in terms of art and media (Szostak, Sułkowski, 2024), our way of communication (Rensburg et al., 2021) due to digital technologies.

However, people without competencies in digital tools could encounter redundancy (Rensburg et al., 2021) and find difficulties in their social lives (Gabriel et al., 2022). Since advanced technologies are evolving eventually including Artificial intelligence, and are starting to dominate (Gabriel et al., 2022), the future will become uncertain and force people to apply their experience in unknown situations (Maor et al., 2024). Therefore, many countries are focusing on improving the digital skills, digital innovation, and creativity of the future workforce (Gabriel et al., 2022; Wang, Lee, 2024).

2.2. Benefits of digitalization and digital literacy in education.

The education system is certainly not exempt from these processes. Various policy documents have already highlighted the digital competency of teachers and students (Spante, 2019). While teachers' professionality is crucial for students (Damanik, Widodo, 2024), students should be up to date with modern technologies (Xia et al., 2024), because the system should prepare young people for a competitive workplace equipped with complex digital technologies (Fernandez, 2019; Wang, Lee, 2024; Damanik, Widodo, 2024). Therefore, several policy documents insist that digital literacy is one of the important skills of the 21st century and should be integrated into the modern educational curriculum as it fosters creativity and collaboration (Tong, 2024; Wang, Lee, 2024; Maor et al., 2024).

Different scientists define digital literacy differently. For example, Gabriel (2022) insists that in Slovenia digital literacy relates to society, in Portugal, it refers to usage and communication, and in Finland and Estonia it is more cross-curricular. The definition of digital literacy has been expanded through the years due to the development of technology. It consisted of acquiring, understanding, and using in 1997, defined as using digital tools confidentially, critically, and innovatively in 2011 (Wang, Lee, 2024), and communication, content creation, and security awareness were added in 2008 by the Digital Competence Framework for Citizens (Ferrari, 2013). While Wang & Lee (2024) provides four kinds of digital literacy, such as photovisual, reproduction, information, and branching, Damanik & Widodo (2024) say the process of being digitally literate occurs when the user acquires an applies (1st stage), gains (2nd stage), and creates (3rd stage). Considering the definitions above, we define digital literacy as acquiring, utilizing, and creating digital products in a confident, innovative, and safe way in our daily lives.

Since digital literacy positively impacts people, including teachers (Damanik, Widodo, 2024) and students, the digitalization of education is also beneficial. The digitalization process in education reflects the transformation of written knowledge into digital knowledge and the advent of a novel approach to disseminating and utilizing educational information (Zhang et al., 2024).

"The process of digitalization in education reflects the transformation of written knowledge into digital knowledge and the advent of a novel approach to the dissemination and utilization of educational information." (Zhang et al., 2024: 2).

Digital tools combined with the Internet have revolutionized the classroom atmosphere by providing interactive and engaging learning experiences. These technologies allow students to access diverse materials for research and reporting, fostering independent learning (Nichols, 2024). Furthermore, the integration of Artificial Intelligence (AI) presents significant opportunities for improving teaching and assessment processes and the management of educational organizations (Niclòs et al., 2024). Digital tools play a vital role in education (Tusiime et al., 2020; Gabriel et al., 2022) by enhancing teaching methodologies (Gabriel et al., 2022; Graessler, Taplick, 2023; Wang, Lee, 2024; Zhang et al., 2024), facilitating student engagement with interactivity (Graessler, Taplick, 2023; Wang, Lee, 2024; Xia et al., 2024; Szostak, Sułkowski, 2024; Damanik, Widodo, 2024), providing new opportunities for assessment (Niclòs et al., 2024) and quality feedback (Wang, Lee, 2024; Damanik, Widodo, 2024), and promoting innovative learning environments for collaboration (Graessler, Taplick, 2023; Damanik, Widodo, 2024; Nichols, 2024). Furthermore, equity in access to technology is vital to help all participants of a learning process reach their full potential (Gabriel et al., 2022). For this reason, integrating digital technologies must align with systems-level approaches that promote inclusivity and support

diverse learners. Also, as curricula evolve toward technology-enriched classrooms, educators must balance their subject proficiency with the ability to facilitate individual and collective learning opportunities (Nichols, 2024).

Digital tools provide the power to break the borders of historical approaches (Szostak, Sułkowski, 2024) in art education. The pandemic due to COVID-19 accelerated the process of digitalization and caused dramatic changes in approaches among creators and representators at any age for creating and presenting artwork (Fernandez, 2019; Wang, Lee, 2024; Xia et al., 2024). Research indicates that the results of the process, such as online exhibitions, web resources, and digital libraries become good tools for learners (Wang, Lee, 2024), as well as connecting bridges between creators and lovers of art (Xia et al., 2024). Adapting digital tools in art classes by teachers led to emerging new materials and teaching methods (Tong, 2024) also leading to the active participation of students (Szostak, Sułkowski, 2024). Nichols (2024) argues that since creating digital art involves a complex process of accurate visual representation of a digital image using a computer and having skills in traditional methods of visual arts at the same time, digital art skills make the creator a well-rounded artist. On the other hand, research has shown that if the student has inadequate digital skills in the learning environment, it could lead to limitations in creativity and innovation when the student starts to work at school (Tusiime et al., 2020).

Furthermore, considering that students in schools will become different specialists in the future, art teachers should focus on preparing young talents with a high level of innovation for society (Wang, Lee, 2024) by utilizing digital art in education, as it has a positive impact to students' creativity (Tusiime et al., 2020).

2.3. Creativity and digital creativity

As an important part of art education (Wang, Lee, 2024), creativity is defined as a process of producing and improving innovative, distinctive, original, effective, and practical ideas (Graessler, Taplick, 2023; Wang, Lee, 2024; Maor et al., 2024; Xia et al., 2024; Tong, 2024). Nichols mentioned micro and macro levels of creativity. While the "Microlevel" is related to the periods when students begin to create, the "Macrolevel" is more evident in the work of artists who go through the full creative process (Tusiime et al., 2020).

When creativity meets digital tools, digital creativity emerges (Rensburg et al., 2021; Wang, Li, 2022). Digital creativity involves technology for thinking, creating, and producing new materials and encompasses several fields such as multimedia and digital art (Rensburg et al., 2021; Wang, Li, 2022). It already has become one of the drivers of the digital world (Wang, Li, 2022).

2.4. How do digital tools foster creativity?

Digital tools influence the creativity of students through emotional and cognitive engagement in learning, collaboration and allow creators to break boundaries of time and space (Wang, Li, 2022; Weng, Chiu, 2023; Wang, Lee, 2024). Studies have proven that providing engagement and interactivity by using digital media tools develops more ideas and creative expression, and even improves learning outcomes (Wang, Li, 2022; Weng, Chiu, 2023; Wang, Lee, 2024; Tong, 2024). Appropriate use of digital tools, in the form of software, hardware, and platforms empowers students to manipulate various mediums (Tong, 2024). Most of the researchers mentioned students and teachers use software such as Adobe Photoshop, Adobe Illustrator, Blender, and Maya; hardware such as Wacom, and iPad; and immersive technologies such as VR and AR (Graessler, Taplick, 2023; Wang, Lee, 2024; Nichols, 2024) for the creation of products in different dimensions. Such tools have unlimited potential to expand the borders of creativity by allowing users to do innovative experimentation (Tong, 2024), manipulate, create, and enhance images (Nichols, 2024), explore new ways of art creation (Wang, Lee, 2024), be interactive (Graessler, Taplick, 2023), share and display fast and easy (Wang, Lee, 2024). This opportunity reflects apparently where teaching creatively meets teaching creativity – in art education. Advanced digital tools have already started to transform the field of painting and provide more space for students to enhance their creative potential (Wang, Lee, 2024). Černochová & Selcuk (2020) also highlight the cyclical nature of creativity and digital literacy not only enhances digital skills but also unleashes students' creative potential.

2.5. Importance of creativity in teacher education.

Creativity is one of the important constructs that are key to the educational process and curriculum in the world (Wang, Li, 2022; Weng, Chiu, 2023; Maor et al., 2024; Niclòs et al., 2024; Zana-Sternfeld et al., 2024). Creativity in teacher education requires a complex approach, encompassing the interconnection between creativity and knowledge, curriculum, and suitable

pedagogical techniques for nurturing creativity within classroom (Zana-Sternfeld et al., 2024). In the technological age creativity in education refers to using various teaching methods, including utilizing technology in class (Tong, 2024). Research has shown that fostering creative thinking in a learning environment reflected positively in working spaces (Tong, 2024) and greatly influenced the quality of learning (Damanik, Widodo, 2024).

Fostering creativity in education necessitates a synergistic relationship between teachers, students, and technology. Research by Damanik & Widodo (2024) mentions the mutual influence between creative teaching practices and teacher professional development.

Two types of creativity are mentioned in education: teaching creatively and teaching for creativity (Maor et al., 2024). Maor et al. (2024) insists teaching creatively involves employing diverse learning strategies that stimulate curiosity and enhance efficacy through numerous instructional methods, including video, animation, and graphics, to accomplish educational goals. Teaching creativity refers to educators' ability to reinterpret innovative notions into methods, strategies, tactics, formats, and resources for instructional activities throughout the learning process (Damanik, Widodo, 2024). Moreover, Zana-Sternfeld (2024) noted creativity is important to fulfill educational needs.

However, current educational frameworks inadequately prioritize creativity, and educators lack support in translating principles that advocate creativity into practical applications. The solution can be reached by raising awareness among educators (Niclòs et al., 2024) and equipping teachers with adequate knowledge (Maor et al., 2024) regarding creativity.

3. Methodology

3.1. Research Design

This study used a mixed-methods approach, specifically a convergent parallel design, in which quantitative and qualitative data were collected simultaneously and then integrated during the interpretation stage. This design was chosen to ensure triangulation of evidence: the survey provided a broad overview of student experiences, while interviews and classroom observations offered in-depth qualitative insights.

3.2. Participants

The study was conducted with the participation of five teachers and sixty-nine students. Teachers were purposefully selected based on two criteria: (a) their direct engagement in creative processes, and (b) their active use of digital technologies in classroom instruction. Student participants, in turn, were included according to two considerations: first, their voluntary agreement to participate in the study; and second, their enrollment in degree programs directly connected to art pedagogy. This selection ensured that both the teacher and student groups were meaningfully positioned within the research focus on digital tools in art education. The sampling procedure followed a convenience approach; however, efforts were made to ensure representation from different year groups and specializations, which allowed us to capture a broad spectrum of student experiences. A sample of 69 participants was deemed sufficient for the purposes of this case study, as it provided the basis for identifying key trends and enabled statistical analysis at the level of a single institutional context. Although the sample size may be considered modest, it represents a substantial proportion of the student population in the given setting and thus offers reliable data for both qualitative and quantitative interpretation. It is also worth noting that the sample size used in this study aligns with norms in comparable research within art pedagogy and related educational fields. In studies exploring the impact of the arts in education, sample sizes have often ranged between 24 and 133 participants, with many falling around 60–70 respondents, which has been shown to be sufficient for detecting meaningful effects when appropriate statistical methods are applied (Schneider, Rohmann, 2021). Accordingly, the participation of 69 students can be considered well-justified in terms of ensuring the validity and informativeness of the findings on the integration of digital tools in art education.

3.3. Data Collection Methods

We used multiple data collection methods to ensure data integrity, accuracy, and openness.

3.3.1. Lesson Observations.

In order to explore the practical use of digital tools in the classroom environment, observations were made in ten separate art classes over two weeks. The observational framework was developed with specific criteria, such as:

– Which kind of digital tools are used in practice (e.g., graphic design programs, online collaboration platforms)?

– How are the lessons engaging: with and without digital tools?

– Is communication between students and professors interactive?

Each observation session lasted approximately 90 minutes, and detailed field notes were taken according to the criteria.

3.3.2. Surveys.

The survey was designed to capture students' perceptions of digital tools used in art education and to collect quantitative data on this. The quality of this diagnostic instrument was ensured through several stages of validation: determining content validity and verifying its accuracy and relevance through an expert review with faculty members specializing in art education. We then pilot-tested the survey with a small group of students (n = 10) to confirm the accuracy, comprehensibility, and consistency of responses, leading to minor adjustments to spelling and vocabulary. Consequently, factor analysis was carried out to examine construct validity, and the results confirmed that the elements coherently grouped into the intended — students' perceptions of digital tools, their influence on creativity, and overall satisfaction with the use of technology. Reliability was tested using Cronbach's alpha, with values between 0.78 and 0.83, indicating strong internal consistency. Overall, these steps provided us with strong evidence about the instrument's validity and reliability for use in this research.

3.3.3. Interviews.

Semi-structured interviews were conducted with a targeted sample of five faculty members actively utilizing digital tools in their classes. The discussions aimed at examining the experiences, difficulties, and advantages participants faced while utilizing technology in arts education. Each interview lasted approximately 20–30 minutes and followed a guiding protocol covering three key domains: (1) Art and Creativity, (2) digital tools in art education, and (3) the role of digital tools to foster creativity. The semi-structured format allowed for consistency across interviews while also providing flexibility for participants to elaborate on individual experiences. With consent, all interviews were audio-recorded and subsequently transcribed verbatim to ensure accuracy of analysis.

3.4. Data Analysis

The thematic analysis was conducted on qualitative data obtained from lesson observations. Recurring themes concerning student engagement and creativity were recognized, and these were subsequently categorized to underscore best practices and potential improvement areas in integrating digital tools.

Interviews were recorded in audio format (with participants' permission) and transcribed word-for-word for analysis. Thematic analysis was utilized to uncover significant themes concerning improving creativity via digital tools. A thematic analysis approach was applied to the interview transcripts following Braun and Clarke's six-phase framework. First, transcripts were read repeatedly to ensure familiarity with the data. Second, initial codes were assigned to meaningful text segments and grouped into broader categories. These categories were iteratively refined into overarching themes and subthemes. Coding was independently reviewed by two researchers, and discrepancies were resolved through consensus, ensuring reliability.

The resulting themes and subthemes are presented in Table 1.

Table 1. Themes and Subthemes from Interview Analysis

Category	Themes	Subquestions
Art and Creativity	*What is the ART* *What is creativity* *Ethical issues (borders) in creativity* *What kinds of creativity do students have in art education?*	*– Which work do you consider as an ART? (Your own opinion);* *– Examples from your class* *– How do you evaluate the work of students as creative;* *– Are there any criteria?* *– As an artist and as an educator of art*

Digital tools	*Integrated digital tools*	
Role of digital tools in fostering creativity	*Role of digital tools to foster creativity* *Assessing the impact of digital tools on students' creative output*	*How are these tools being used to encourage students to create, design, or innovate? Do you use digital tools for this process?*

Quantitative data extracted from surveys were examined using descriptive statistics to summarise participants' responses. Almost all answers were in Slovak, so they were translated into English, and where responses were long, they were summarised and generalized into topics. Moreover, inferential statistics were employed to determine connections between the utilization of digital tools and students' creativity levels.

3.5. Case Study Setting

The case study was conducted at the Department of Creative Arts and Art Education within the Faculty of Pedagogy at Constantine the Philosopher University in Nitra (NKF), Slovakia.

3.5.1. Overview of the Department of Creative Arts and Art Education.

The department was established in 1960 when it was separated as an independent workplace from the Department of Art Education and Fundamentals of Industrial Production. The curriculum integrates both traditional artistic techniques and contemporary digital practices. The priority professional area of the department is research focused on didactic-methodological issues of training art teachers, which includes questions from the theory of teaching, specific problems of visual communication, and exegetical interpretation of a work of art with a focus on active work with works of art and verbal communication.

The Department is well-equipped with modern technological resources that support the integration of digital tools into art education. They have two computer labs provided with hardware for digital drawing and access to the Internet. The conditions created and the digital art projects implemented in the department can provide a very favorable environment and the necessary conditions for the case study.

4. Results and Analysis

In Phase I of the case study, we investigated prior experience, the purpose of the usage, and the perceptions of teachers and students in the department about integrating digital tools. The process involved lesson observations, interviews, and a survey among students. For the observation, different technology-related subjects such as Digital media in education, Intro to digital media, IT and Art, Creating Video-photo, Digital photography, and art-related subjects such as Didactics at school, Methodic in Art education, Book design, Intro to visual arts, and Textile design were chosen. Five faculty members were involved in the interview.

Observations and interviews revealed that all classes and teachers use the internet, video, social media, and browsing during class. However, students and teachers only use software in technology-related subjects, and a limited number of classes include digital tools for collaborative or interactive activities during class.

4.1.Results of the survey: Phase I.

The survey participants were mostly art or art-combined major students (Figure 1a) of different ages (Figure 1b) and levels of study (Figure 1c).

4.1.1. Prior Experience of Students with Digital Technology

The data revealed that a significant portion of participants (91 %) were familiar with digital tools at a different level, while a small number reported they had not experienced it (9 %). In detail, 47 students have used tablets, indicating it's the most common digital tool among the students, 55 students have experience with graphic design software, 15 students have used 3D modeling software, and 4 students have VR. One participant, even having a piece of basic knowledge, has not used any digital tools for a long time. On the contrary, the students, who considered themselves not experienced, tried to use a certain digital tool (Table 2).

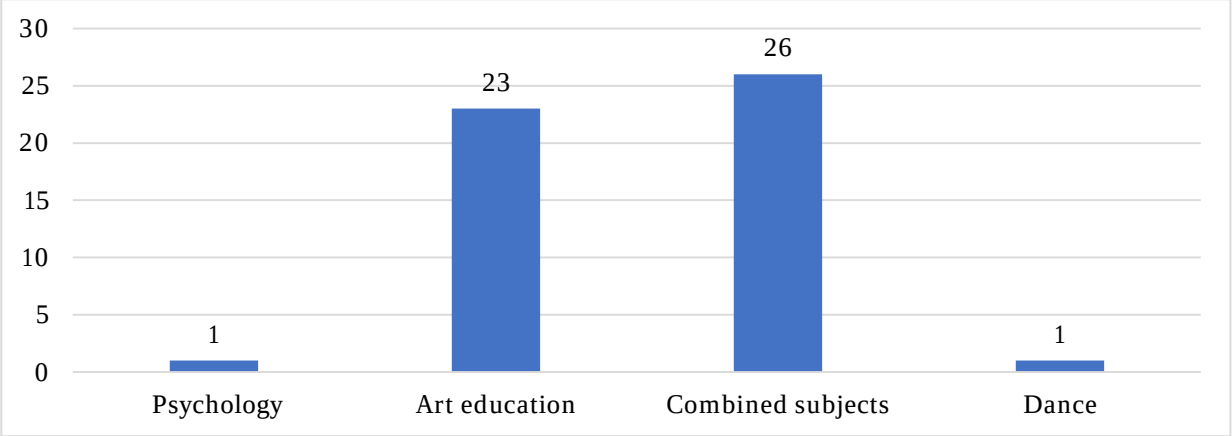

Fig. 1a. Demographics of participants: Majoring (Phase I survey)

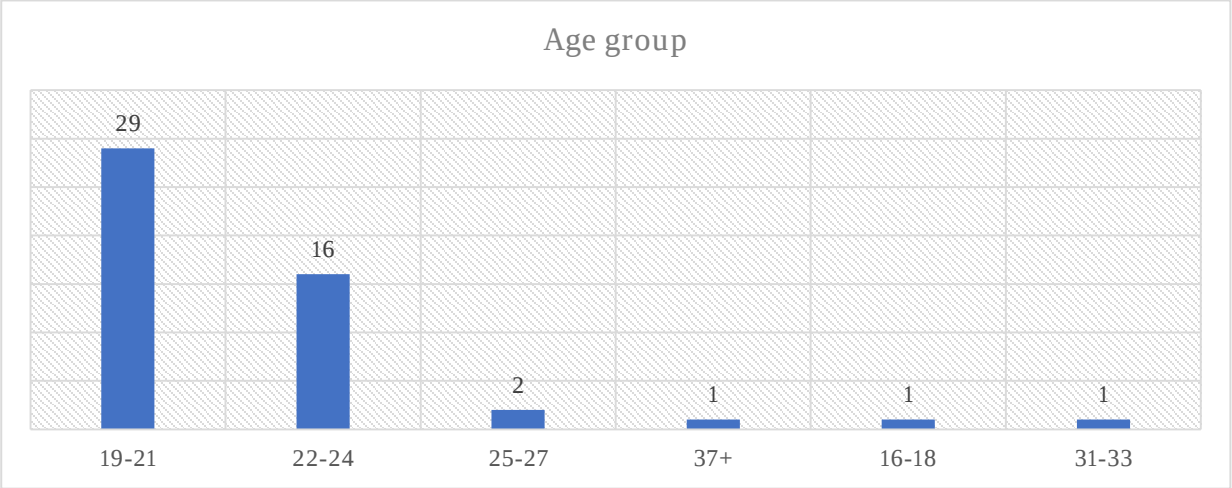

Fig. 1b. Demographics of participants: Age group. (Phase I survey)

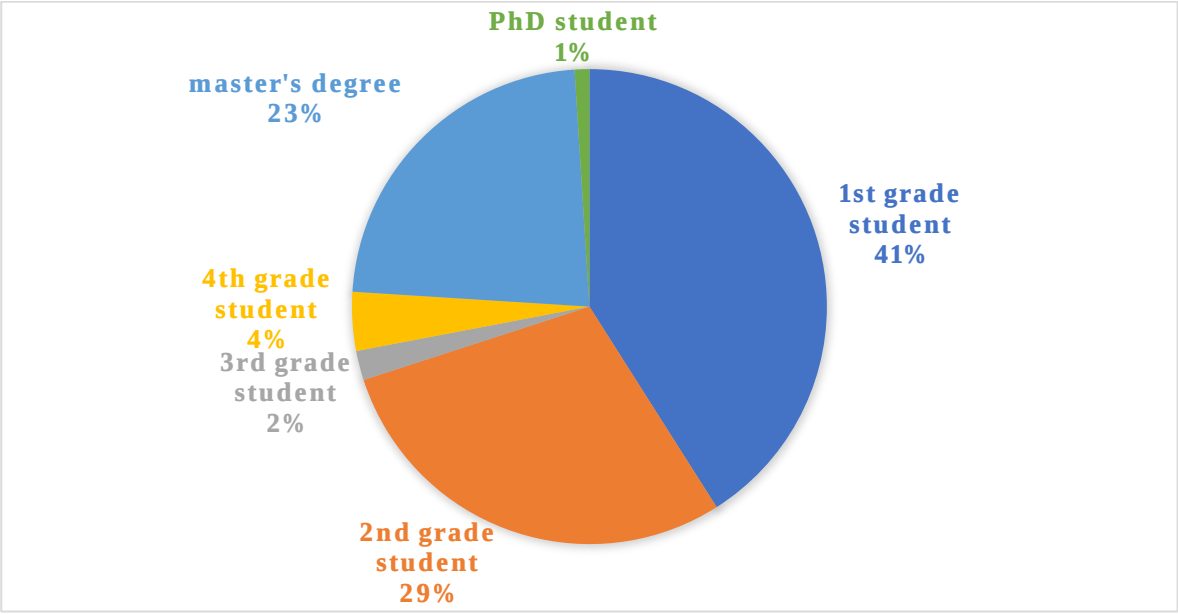

Fig. 1c. Demographics of participants: Grade level (Phase I survey)

Table 2. Levels and prior experience of participants with digital tools

Levels	Number of students	Prior experience				
		Tablet (e.g.: iPad)	Graphic design software	3D modeling software	VR	Did not use
Advanced	11	10	10	7	0	0
Intermediate	25	16	22	7	2	0
Basic	28	17	22	1	2	1
Low	5	4	1	0	0	0
Grand Total	**69**	**47**	**55**	**15**	**4**	**1**

4.1.2. Frequency and Purpose of the usage in formal and informal cases.

The predominant purpose of using Digital tools was for Digital art (68), Graphic design (54), and Learning (39) both within and outside educational settings. Students who created digital artworks mostly mentioned sketching, drawing, painting, comics, illustrations, and designs for printing materials. Graphic design creators used software for photo editing, restoring, animation, and creating posters. Students who used it for earning purposes mostly created presentations and searched for information.

Notably, the overall use of technology was significantly higher in outside-of-school settings than in the lessons. Interestingly, digital tools were used for leisure activities in students' free time, with communication as another prominent purpose (Table 3). It could be concluded that the appropriate integration of digital tools into the educational process should be investigated, considering users' interests and aspirations to use technology.

Table 3. Usage of digital tools in and out of school cases

Purposes	In-school usage				Out-of-school usage					Total
	daily	often	sometimes	rarely	daily	often	sometimes	rarely	do not use	
Graphic design	1	14	13	8	11	7	0	0	0	**54**
Digital art	3	19	13	8	20	3	0	2	0	**68**
Learning	0	7	4	6	17	4	0	1	0	**39**
Communication	0	0	0	0	11	4	0	0	0	**15**
Earning	0	0	0	0	2	2	0	0	0	**4**
Leisure	0	0	0	0	27	8	1	2	0	**38**
Do not use	0	0	0	0	0	0	0	0	3	**3**
Total	**4**	**40**	**30**	**22**	**88**	**28**	**1**	**5**	**3**	

4.1.3. Student Perceptions of Digital Tools

Regarding perceptions of students whether digital tools can enhance their creativity and innovation, most of them agreed. However, it is notable that the number of strongly agreed students was less than those who just agreed. Moreover, the number of neutral students is also

noteworthy (Table 4). It can be concluded that despite the agreement on the impact, students have doubts about digital tools and their effectiveness in creativity.

Table 4. Perception of students about the impact of digital tools to enhance creativity

Labels	Amount
Strongly agree	22
Agree	31
Neutral	15
Strongly disagree	1
Grand Total	**69**

Their answers to the question "How innovative do you feel your digital art projects are compared to traditional methods?" also supported this idea. From Figure 2 we can see that the highest number of respondents evaluated the effectiveness of digital tools at the middle level.

Moreover, interviews also supported these results. Most of the teachers argued that Digital tools are undoubtedly useful and impact creativity in art education; however, they are not yet developed enough to unlock students' full potential in terms of creativity.

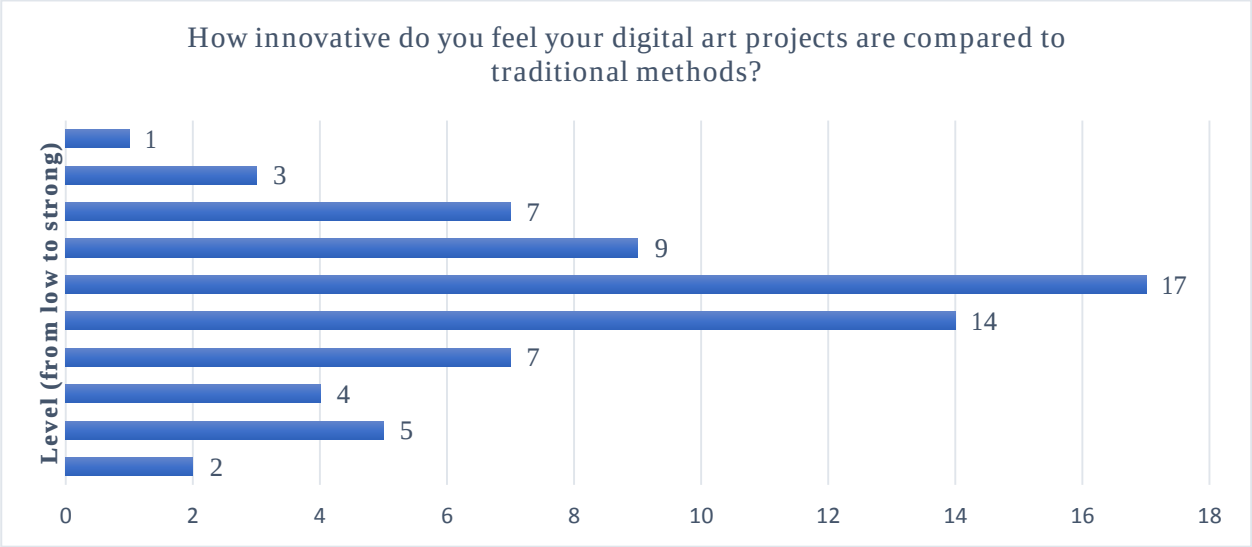

Fig. 2. Perception of how digital tools are innovative compared to traditional ones

In the following answers, students supported their agreement or disagreement (Table 5a and 5b). Results revealed that most students believe that digital tools are beneficial for creativity (27), and learning (13). While some students think such tools are useful for inspiration (6), collaboration, and feedback (3), only a limited number prefer them as they offer unlimited possibilities to create (2) and they are good sources for idea generation (1).

On the contrary, a few students hold negative views about using digital tools for creative purposes. Two of them think that digital tools are only practical, while one claims they are not interesting, and another prefers traditional methods rather than digital ones.

In the survey, students were asked which digital tools they had used recently to explore what software they use in actual practice.

Photoshop and Illustrator are the most prevalent digital art tools among the surveyed individuals, with 18 and 8 choices respectively. InDesign and Rebelle followed them with 5, while GIMP and CorelDraw are used by a smaller group of 4 and 3 respondents respectively. The remaining tools, including Procreate, Clip Studio Paint, Lightroom, SAI, Sketchbook, Autodesk Sketchbook, Leila, PowerPoint, Ad Fresco, Medi Bang Paint, Pixel R, Flash, and Cinema 4D, are used by 2 or fewer respondents each (Figure 3).

Tables 5a and 5b. Students' positive (a) and negative (b) insights about the influence of digital tools on creativity

Table 5a.

Levels	Reasons						
	Useful in Creativity	For idea generation	Learning	Inspiration	Collaboration and feedback	Unlimited possibility	No reason
Strongly Agree	5	1	1	0	0	1	0
Agree	15	0	12	4	3	0	1
Neutral	7	0	0	2	0	1	12
Total	27	1	13	6	3	2	13

Table 5b.

Levels	Reasons			
	Not interesting	Only practical	The traditional approach is better	Did not help
Do not agree	1	1	1	0
Strongly disagree	0	1	0	1
Total	1	2	1	1

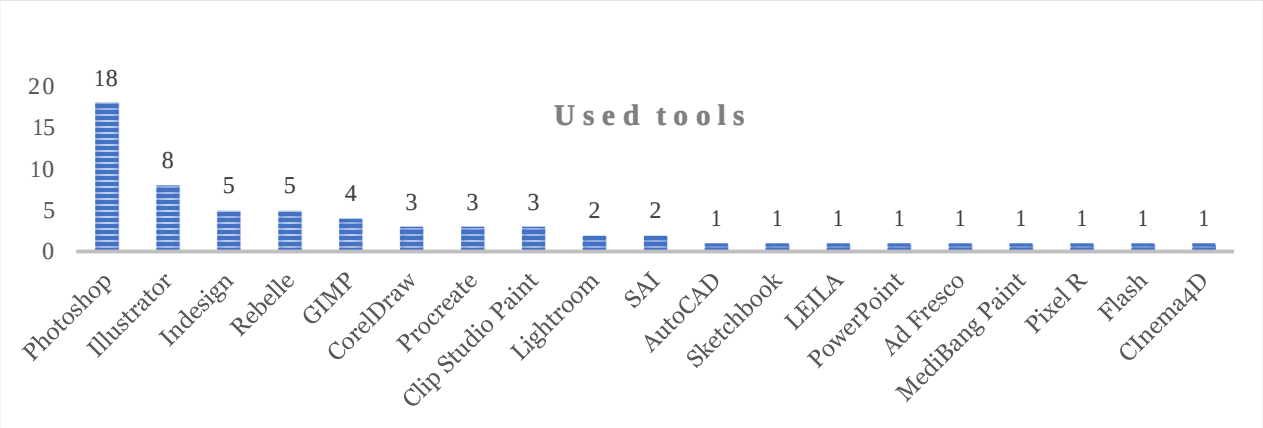

Fig. 3. Previously used software by students

The observation and interviews with faculty members supported the survey's findings. While teachers mentioned Photoshop, Illustrator, and InDesign as more effective tools for Graphic design and Book illustration, Rebelle was the most preferable software for resembling traditional art in digital space.

Participants' overall perceptions of integrating digital tools into art education were mostly average (Table 6). They think technologies provide an opportunity to experiment with a variety of materials without waste (57) and access to a greater range of tools and resources (55), helping to instant feedback (21) and collaboration (11).

Table 6. The overall perception of integrating digital tools into art education

Levels	Reasons			
	Accessibility to a greater range of tools and resources	**Experiment without wasting materials**	**Instant feedback**	**Collaboration**
Excellent	6	6	5	0
Good	19	21	7	4
Average	23	20	8	5
Bad	7	10	1	1
Total	**55**	**57**	**21**	**11**

4.2. Phase II: Implications and Outcomes

Class observations, Phase I surveys with students, and interviews with teachers have revealed digital tools in art education are not only about creating artwork on display but also about creating engaged classrooms during the lesson. According to Tables 2, 3a, and 4, students prefer to use digital tools for collaboration and feedback besides painting and drawing. Therefore, in Phase II students were given a task preparing a presentation about any topic related to the subject. The task focused on experimenting with improving their collaborative, innovative, and digital creativities which are necessary for their future career. Overall, 22 students were involved in the process as they used digital tools actively throughout the classes.

All presentations involved some kind of digital tool for engagement and interactivity. The most used examples were 360^0 videos, QR codes, and interactive games prepared on Kahoot, Canva, Mentimeter, and AhaSlides.

“Digital tools helped to increase my creativity by inventing the design of the presentation and the method of execution.” – Hana Duricova, 1st grade student in the Department of Creative Arts and Art Education.

All students mentioned that using tools helped to make the presentation more engaging, especially when the class was involved in interactive games.

“It helped me to spark interest in the class and concentrate the attention of my classmates through games, and it increased my collaborative creativity...”-Yelena Zolotarova, 1st grade student in the Department of Creative Arts and Art Education.

The results suggest a generally positive perception of digital tools for engagement, collaboration, and impact on creativity, with scores predominantly ranging from 7 to 10 on a scale (Figure 4).

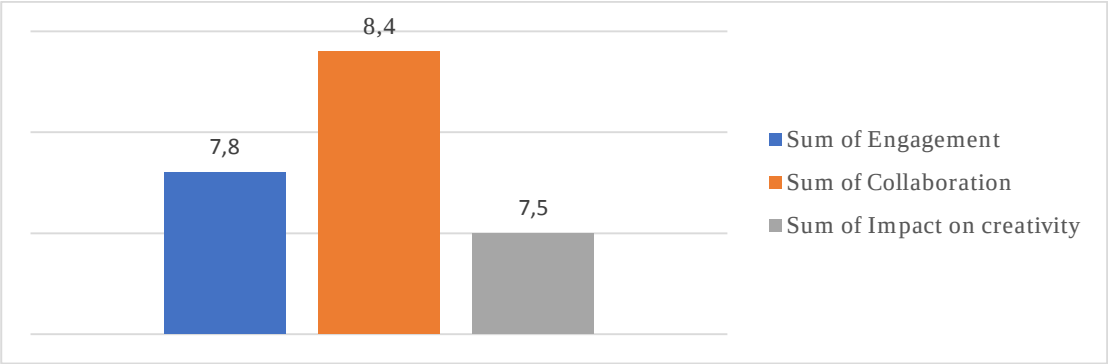

Fig. 4. Overall satisfaction of students on the impact of digital tools

4.3. Challenges in the integration of digital tools into Art Education.

Observations, surveys (in both phases), and interviews argued the significant challenges are related to technological, financial, and educational issues.

The most significant challenge, with 31 students raising concerns, lies in the area of literacy. Students expressed extra time for mastering the tools, being careful of plagiarism, constant effort to keep the current level or improve the knowledge, keeping a balance between technology and traditional methods, having a quality teacher, and dealing with technology.

A significant number of students reported financial constraints as a barrier. The reasons included the difficulty of affording digital tools and the financial demands of using subscribed software versions.

Likewise, some students indicated technological issues such as crashing in unexpected moments, having quality Internet, and using updating tools (Table 7).

Table 7. Challenges in the integration of digital tools

Category	Number of students	Specific reasons
Literacy	31	Requires extra time to learn; Prone to plagiarism; Constant efforts; Keep a balance between digital and traditional creativity; Lack of professional teachers in this field; Deal with technology;
Financial	13	Not anyone can afford a digital tool (personal or at school); expensive subscription to programs
Technical issues	10	Unexpected crash of the software; Access to the Internet; Updating tools;
I do not know	9	Can not explain
None	2	Can not explain

4.4. Summary of Key Findings

4.4.1. Quantitative Results

A series of chi-square (χ^2) tests were conducted to examine the significance of relationships in the data:

Proficiency level and Prior tool use (Table 2`). $\chi^2(9, N = 69) = 13.80$, $p = 0.129$. No significant association was found between students' level of proficiency and the types of digital tools they had previously used.

Purpose of use and Frequency of use (Table 3). $\chi^2(6, N = 69) = 7.87$, $p = 0.248$. No significant relationship was identified between students' reasons for using digital tools (graphic design, digital art, learning) and their frequency of use.

Attitudes toward digital tools (Table 4). $\chi^2(3, N = 69) = 19.12$, $p < 0.001$. Students' responses were not evenly distributed, with "Agree" (31) and "Strongly agree" (22) being significantly more frequent than expected under uniform distribution.

Phase I and Phase II comparison (Creativity and Collaboration).

Comparing students' initial expectations (Table 5a, 5b) with their subsequent evaluations (Figure 4), a clear shift can be observed. In Phase 1, creativity (n = 27) and learning (n = 13) emerged as the dominant reasons for using digital tools, whereas collaboration (n = 3) and feedback (n = 3) were mentioned only rarely. In Phase 2, however, experimentation (n = 57) and access to a broader range of tools (n = 55) were identified as the most salient benefits, while collaboration (n = 11) and feedback (n = 21) gained much higher recognition compared to the initial phase. Negative reasons were minimal in both phases (Phase 1: n ≤ 2; Phase 2: "Bad" = 7), confirming the overall positive perception.

4.2. Qualitative Results: Interview Findings

Analysis of five semi-structured interviews with teachers revealed consistent understandings of the integration of digital tools into arts education and emerged four main themes – creativity

and experimentation, engagement and motivation, barriers and challenges, and needs for institutional and professional support.

Creativity and experimentation. It was also found that digital tools can play an important role in expanding opportunities for creativity and expression by allowing students to utilize new media without fear of mistakes or material waste. This freedom led to encouragement for innovation and the exploration of new artistic directions.

"Creativity is an approach to solve a problem unusually when the usual way does not work." — **PaeDr. Janka Satkova**, head of the Department of Creative Arts and Art Education.

Engagement and motivation. Motivation, as well as engagement, was consistently observed among students during the lessons when digital tools were incorporated into the learning process. Tablets, design software, or digital platforms made the lessons more dynamic, leading to active participation and enthusiasm.

"Lessons with digital technologies were more dynamic, and students showed visibly higher interest." — **Adriana Recka,** Assoc. prof., PhD.

Barriers and challenges. Instructors pointed out some difficulties in the integration process. It includes lacking of digital tools, insufficient training, and sometimes, students' objections to the digital approaches were most often mentioned as an obstacle to successful integration.

"Some students still prefer traditional methods and hesitate to use technology, which slows down the process." — **Lubomir Zabadal,** PhD.

Support needs. Another notable topic was the value of institutional and professional support. Instructors elaborated on support around and the organization of advanced training, workshops, and continuous methodological support required to ensure sustainable integration of digital tools into everyday teaching practice.

"Workshops are helpful tools for teachers in order to integrate them more effectively and make better use of the available resources." — **Jan Hunady,** PhD.

RQ1: What are the prior experiences and perceptions of teachers and students in the department regarding integrating digital tools in art education?

The research findings show that students have prior knowledge of digital technologies and how to use them in creative processes regardless of a medium. However, most of their experiences had primarily to do with using the instruments as artists and not using them in teaching. This showed a disparity between how tools are used now and the ways they could be used in teaching.

Faculty Insights: Views of the Faculty The faculty's feelings about the use of digital tools were somewhat contradictory. Although they pointed out the need for merging the tools in the teaching part, they argued that it could improve the creative aspects of art.

RQ2: What specific digital tools are used and perceived by students as effective for creativity in visual arts education?

It was identified effectiveness of several digital tools for fostering creativity in visual arts education, such as:

– Graphic design software (e.g., Adobe Creative Suite)

– Digital art applications (e.g., Rebelle, GIMP)

The results suggest integrating various digital tools into art education curricula is beneficial to build creativity and innovation skills among future educators.

RQ3: Which digital tools should be integrated into the educational process to build future visual arts teachers' creativity and innovation skills as educators?

Research shows that future art teachers will need to gain organizational skills as well as artistic creativity during their study. Such skills include, but are not limited to, collaborative, innovative, and digital creativity. Therefore, integration of instruments that are intended to foster interactivity and collaboration is crucial.

RQ4: What are the potential challenges and limitations associated with integrating digital tools in art education?

A notable challenge was the lack of access to suitable materials as a result of financial issues. It was emphasized that a substantive percentage of students can only afford to purchase only basic digital hardware and software.

As a result, there is a lack of teaching approaches that support the fusion of technology in teaching and learning art, which may impact the teaching of digital skills. Furthermore, some learners were reluctant to engage in the use of digital technologies because of the doubts that were raised regarding the effectiveness of these tools in enhancing creativity.

5. Discussion

In summary, digital tools' positive impact in the field of art education have been emphasized among different student categories, contexts, and art sub-disciplines. The low statistical significance in Tables 1 and 2 proved that benefits were not restricted to a few student subgroups nor to select purposes of use, which suggests a more widespread distribution within the balance of the general population.

Perhaps more telling is the overwhelming student response to the role of digital tools in boosting creativity which is backed by strong statistical significance within Table 3. This particular finding aligns with the most recent literature that digitally driven pedagogies within arts education have the potential to actively stimulate innovation and creativity.

Furthermore, the comparison between Phase I and Phase II results ($\chi^2(1, N = 86) = 0.20$, $p = 0.654$) demonstrates a high degree of consistency: the expectations expressed by students at the outset regarding creativity and collaboration were confirmed by their reported experiences. This consistency reinforces that the research is based on the right approach and highlights that the perceived benefits of digital tools are indeed effective in practice.

Considering the findings of the study, it is noted that the use of digital tools in art education enhances students' creativity and engagement. This study also indicated that the use of digital tools in preparing art teachers has a positive correlation with students' creativity, engagement, and willingness to take risks with their work. These findings align with recent research that investigated the intersection of digitalization and creativity. For instance, in a study carried by Wang and Li (2022), it was confirmed that digital tools in STEM education improved students' creative thinking skills, which is similar with our findings, whereby creative thinking and experimentation were the most reported benefits by the students. Similarly, Janse van Rensburg, Coetzee, and Schmulian (2021) argued that digital assessment can foster creativity; their findings are also supported by our study, in which students reported that the use of technology fostered creative expression.

The relationship between nurturing digital skills and fostering creativity is also seen in Wang and Lee (2024). Research showed a relationship between digital competency and creativity of students in the visual arts, and this aligns with our findings, which demonstrate that students who are exposed to using digital tools can produce artworks that are much more original. At the same time, the structural support mentioned in the interviews is consistent with Tusiime, Johannesen, and Gudmundsdottir (2020), who reported that teacher educators in Uganda had to struggle with infrastructural and pedagogy problems while teaching art and design in the digital world. Similarly, our data described the inadequacy of resources and the absence of training.

From the interviews, the participants emphasized collaboration and feedback on digital engagement, which is similar with ideas of Fernandez (2019), who claimed that including collaboration in the educational system of higher education can foster inclusion and shared learning activities. Also, Zhang et al. (2024) demonstrated that educational digitalization improves some aspects of creativity of students with special needs through creative self-efficacy. Likewise, feedback and collaboration through digital tools can support various learner dispositions, which our study reinforces.

The results also echo Spante (2019), who emphasized the importance of digital storytelling and creative production as effective methods for fostering digital creativity. In our study, both students and teachers emphasized the importance of experimentation and active engagement with digital media for learning. Furthermore, the emphasis on institutional and professional support in our findings aligns with the findings of Gabriel et al. (2022), who documented how global digital education strategies depend on well-designed policies and institutional practices.

At the same time, the study offers new insights by demonstrating how students' initial expectations regarding creativity and collaboration (Phase I) were confirmed by practice (Phase II). This consistency not only confirms the more general findings of Haleem et al. (2021), who examined the positive educational role of digital technologies, but also expands the literature by demonstrating the growing recognition of the benefits of collaboration in real-world classroom practice.

6. Conclusion and recommendations

This study demonstrates that integrating digital tools into arts education consistently fosters student creativity, experimentation, and engagement across diverse groups and contexts. Statistical analysis confirmed high levels of student support for digital technologies, and a comparison between Phases I and II demonstrated that initial expectations regarding creativity and collaboration were realized. The results are consistent with previous research emphasizing the role

of digital media in fostering innovation and highlighting the growing importance of collaboration and feedback as additional benefits. Although the small sample size limits generalizability, the results strongly suggest that digital technologies represent a valuable resource for fostering both individual creativity and collaborative learning in arts education.

Based on the results of this study, several practical and scientifically based recommendations were developed:

– Creative experimentation should be supported. It is important to provide wider access by institutions to diverse resources related to digital creativity in order to encourage exploration, facilitate trial-and-error learning, and give an opportunity for innovative artistic expression.

– Strengthen collaborative opportunities. Digital platforms should be expanded by facilitating peer-to-peer collaboration, offering group projects, and creating structured feedback processes, as the benefits of these crucial aspects have emerged in Phase 2.

– Invest in teacher training. Educators should be empowered through sustained professional development programs focused on pedagogical strategies that incorporate the integration of digital technologies into the arts education.

– Address technical and institutional barriers. To fully enable digital integration, educational institutions must provide the essential technical support, provide broader material and technical base, and offer institutional support required to reduce systemic obstacles.

– Future research. Future studies should include larger, more representative samples and, perhaps, explore in more depth how digital tools influence not only individual creativity but also collaborative learning methods in arts education.

Furthermore, classroom observations have shown that digital tools are ineffective in fostering creativity and engagement if they span the entire lesson. In such cases, this can lead to students feeling resistant to technology. Therefore, physical and digital activities should be balanced in the learning process.

7. Limitations of the study

It is important to note that the relatively small sample size (N = 69) and the non-random nature of the participant selection represent some limitations of this study. These factors limit the generalizability of the findings, as they primarily reflect the conditions of a single institution and may not be representative of all art education contexts. Furthermore, the use of a contingency sample may introduce some bias, as more motivated or digitally literate students may have been overrepresented. These limitations should be taken into account when interpreting the results. Future studies should consider increasing the sample size, diversifying institutional settings, and using probability sampling methods to increase representativeness and external validity.

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Gender and Mathematical Anxiety by Younger School-Age Children

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Abstract

Studies on mathematical anxiety have long suggested a relationship between mathematical anxiety and gender. At the same time, the question arises whether mathematical anxiety is already present in younger school-age children. Previous research has shown inconsistent results, highlighting the need for further data. Therefore, the primary aim of this study was to determine whether mathematical anxiety occurs in younger school-age children and, if so, what the relationship is between mathematical anxiety and the gender of the children. Participants consisted of 257 fifth graders. Our results did not confirm the presence of mathematical anxiety in the studied sample of younger school-age children, nor did show a statistically significant difference between boys and girls in anxiety levels. The inconsistency in research results could also be explained by other variables that may affect mathematical anxiety. The presented results should serve as a basis for further research aimed at identifying factors that influence the development of mathematical anxiety and the specifics of its occurrence with respect to age categories.

Keywords: math anxiety, gender, primary education.

1. Introduction

The term mathematical anxiety was defined by Richardson, Suinn (1972) and characterized as “a feeling of tension that significantly interferes with the manipulation of numbers and the solving of mathematical problems” (Richardson, Suinn, 1972: 551). It also involves feelings of fear, worry, and/or anxiety with behavioural manifestations such as tension, frustration, helplessness, anxiety, and mental disorganization (Richardson, Suinn, 1972), which arise from mathematical stimuli (Ashcraft, 2002).

Scientists long believed that the onset of mathematical anxiety begins only after transitioning to upper elementary school, despite numerous accounts from adults who reported that their mathematical anxiety stemmed from early experiences with mathematics (Jackson, Leffingwell, 1999). The lack of data on mathematical anxiety in younger school-age children in the past was

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likely due to studies that did not show any consistent relationship between mathematical anxiety and performance in elementary school (Dowker et al., 2012; Krinzinger et al., 2009), which may have led some researchers to doubt whether young children experienced mathematical anxiety and, if so, whether they were capable of describing their feelings. The ability of children to report experiencing mathematical anxiety is still a topic of professional discussion (Ashcraft, Krause, 2007; Vuković, Kieffer et al., 2013; Ganley, McGraw, 2016). However, recent research indicates that younger school-age children are capable of understanding and reporting their feelings of mathematical anxiety. Cognitive tests and interviews in several studies have shown that children have a good understanding of what it means to be nervous, anxious, or tense about mathematics (Ramirez et al., 2013; Vuković, Kieffer et al., 2013, Ganley, McGraw, 2016). Interestingly, even children at the very beginning of their schooling reported experiencing mathematical anxiety (Ramirez et al., 2013; Gunderson et al., 2017).

Studies comparing levels of mathematical anxiety between men and women indicate that women typically exhibit higher levels of mathematical anxiety than men (Miller, Bichsel, 2004; Devine et al., 2012; Ferguson et al., 2015; Jansen et al., 2016). Significant differences in mathematical anxiety have also been found among high school students, with girls reporting higher levels of mathematical anxiety than boys (Else-Quest et al., 2010; Goetz et al., 2013; Hill et al., 2016). In a study by Stoet et al. (2016) mathematical anxiety was measured among 761,655 high school students from 68 countries. The researchers found that female participants reported greater mathematical anxiety than male participants, and this difference was even larger in economically developed countries with higher levels of gender equality. Similarly, a study by Devine et al. (2012) on high school students shows that girls exhibit higher levels of mathematical anxiety than boys. Researchers in China also reached the same conclusion, finding that female high school students exhibited statistically significantly higher levels of anxiety than their male counterparts (Luo et al., 2008).

As the data suggests, the search for a relationship between mathematical anxiety and gender has been the subject of numerous studies in mathematical education. However, these studies do not arrive at definitive conclusions, which may be due to the application of various research tools. For example, Arigbabu et al. (2012) found in a sample of high school students in Nigeria that men are more anxious than women. The authors also note that the research results may have been influenced by recent awareness-raising in Nigeria, which educates and motivates women to take more mathematics courses. Other studies, however, indicate that there is no significant difference between the mathematical anxiety of men and women (Hamza, Helal, 2013; Keshavarzi, Ahmadi, 2013). Levels of mathematical anxiety among high school students in Malaysia also showed no significant difference between men and women (Zakaria et al., 2012). These research results suggest social and cultural determination, as residents of different regions show different results (Zhang et al., 2019). The finding that mathematical anxiety is observed worldwide (Barroso et al., 2021) and is more likely to occur in women and individuals with low income also supports the influence of social factors as a factor in mathematical anxiety (OECD, 2013).

It could be said that the relationship between gender and mathematical anxiety has not yet been definitively proven despite numerous studies, as the findings have been inconsistent. While there are many studies that have found significantly higher levels of mathematical anxiety in women compared to men, there are also many studies that show no gender-based differences in mathematical anxiety within the population. Additionally, there are several studies that have found higher levels of mathematical anxiety in men compared to women. Birgin et al. (2010) suggest that the lack of consistent gender effects may be due to mathematical anxiety not being consistently defined or measured.

Despite the ambiguous research results, some scientists continue to operate on the premise that mathematical anxiety is more common in women than in men. To this day, however, there is no definitive answer to the question of why women and girls should exhibit higher levels of mathematical anxiety compared to men.

Beilock et al. (2007) proposed a possible explanation, suggesting that the gender difference in reporting mathematical anxiety is a result of social stereotypes. This hypothesis is supported by research (Goetz et al., 2013), in which students were asked to describe their mathematical anxiety outside of a school setting. The result was that girls reported greater mathematical anxiety than boys. However, when researchers gathered information from students about their mathematical anxiety in real-time during a math test, girls did not exhibit more symptoms of anxiety than boys. Further research revealed that mathematical anxiety was higher among students with low

mathematical self-esteem and those who endorsed the traditional gender stereotype that mathematics is traditionally a male-dominated field (Bieg et al., 2015).

The question of whether gender differences in mathematical anxiety occur in primary school children remains unanswered. Of the few studies conducted, most have found no differences between genders in reporting mathematical anxiety (e.g. Gierl, Bisanz, 1995; Vukovic et al., 2013; Newstead, 1998; Punaro, Reeve, 2012; Ramirez et al., 2013; Young et al., 2012). However, some studies indicate that girls already exhibit higher levels of mathematical anxiety than boys at the primary school age (e.g. Griggs et al., 2013; Yüksel-Şahin, 2008).

2. Discussion and results

Research objectives and research design

We sought to answer the following research question: Does gender significantly affect levels of math anxiety among primary school children?

Research hypotheses:

H_0: There is no statistically significant difference in the level of mathematical anxiety between boys and girls.

H_1: There is a statistically significant difference in the level of mathematical anxiety between boys and girls.

Theoretical background: The research is grounded in the cognitive-affective model of math anxiety (Ashcraft, 2002), which views anxiety as an emotional reaction interfering with cognitive processing. Additionally, elements of social role theory (Eagly, 1987) provide a framework for interpreting potential gender differences in anxiety experiences.

The aim of this study was to investigate the prevalence of math anxiety among primary age children and to examine the relationship between math anxiety and gender of elementary school students.

In this research, a combination of descriptive and quantitative research design was used, focusing on the analysis and description of the distribution of mathematical anxiety in children. The following elements highlight specific aspects of the research design:

a) Data Collection: The dataset was obtained using the mAMAS-E questionnaire, which assessed mathematical anxiety on a scale from 1 to 5. This approach allowed for the systematic collection of students' subjective evaluations.

b) Descriptive Statistics: The research focused on describing basic statistical characteristics. Histograms and box plots provided a visual overview of the distribution of mathematical anxiety, which is typical for a descriptive design.

c) Group Comparison: The research analyzed differences between groups (boys vs. girls) using box plots and the Kolmogorov-Smirnov test, examining the relationship between gender on anxiety. This aspect corresponds to the quantitative approach within the descriptive design.

d) Hypothesis and Testing: The null hypothesis regarding the concordance of distribution functions was tested for both genders, which is a common procedure in empirical research, enhancing the rigor of the design.

Software: All statistical analyses were conducted using R (version 4.0.3, R Foundation for Statistical Computing).

Overall, this research utilized a combination of descriptive and quantitative approaches to analyse and interpret the results, with an emphasis on precise measurement and data visualization.

Research sample

Overall, 345 children from 21 different Slovak schools took part in the study. Schools that participated were chosen from all regions of Slovakia including cities and villages. The classroom size consisted of 13 to 30 pupils whose socio-economic status varied. Participants with incomplete questionnaires were excluded. Thus, the final sample consisted of 257 children who were 10 to 13 (M = 10.9, SD = 0.48) years old. There were 134 male and 123 female participants all attending 5th grade.

Materials for testing

To examine the math anxiety among primary age children, the Modified Abbreviated Math Anxiety Scale for Elementary Children (mAMAS-E) was used.

The mAMAS-E (Carey et al., 2017) is a nine item, self-reported questionnaire designed to measure MA. The mAMAs-E uses five-point Likert-type scale, where one represents no anxiety at all and five corresponds to high levels of MA. We used the pictorial Likert scale with a verbal

description of emotions. The MA score was calculated by summing up all the item scores, with total score ranging from 9 to 45 points. It takes approximately 15 minutes to complete the mAMAS-E (Osaďan et al., 2022).

Reliability: The internal consistency of the mAMAS-E in this study was not computed; however, reliability was supported by previous studies reporting Cronbach's alpha = 0.85 (Carey et al., 2017).

The mAMAS-E (Carey et al., 2017) is a nine item, self-reported questionnaire designed to measure MA. The mAMAs-E uses five-point Likert-type scale, where one represents no anxiety at all and five corresponds to high levels of MA. We used the pictorial Likert scale with a verbal description of emotions. The MA score was calculated by summing up all the item scores, with total score ranging from 9 to 45 points. It takes approximately 15 minutes to complete the mAMAS-E (Osaďan et al., 2022).

Testing procedure

The tests were administered by the teachers at each school. Prior to the experiment, each school received instructions on test administration. These instructions included reading the mAMAS-E questions aloud to the children and providing them with a definition of anxiety written in age-appropriate language. The teachers were asked to define and explain the terms to the children. All students completed the testing within one day.

Data analysis and results

Mathematical anxiety in children was calculated based on the mAMAS-E questionnaire, which contained nine items related to anxiety in mathematics. The student indicated the level of anxiety for each item on a scale from 1 (very low anxiety) to 5 (very high anxiety). The resulting score of mathematical anxiety was obtained as the sum of the scores for all items, meaning the student's final anxiety score could range from 9 to 45. The frequency distribution for individual values is shown in graph (see Figure 1).

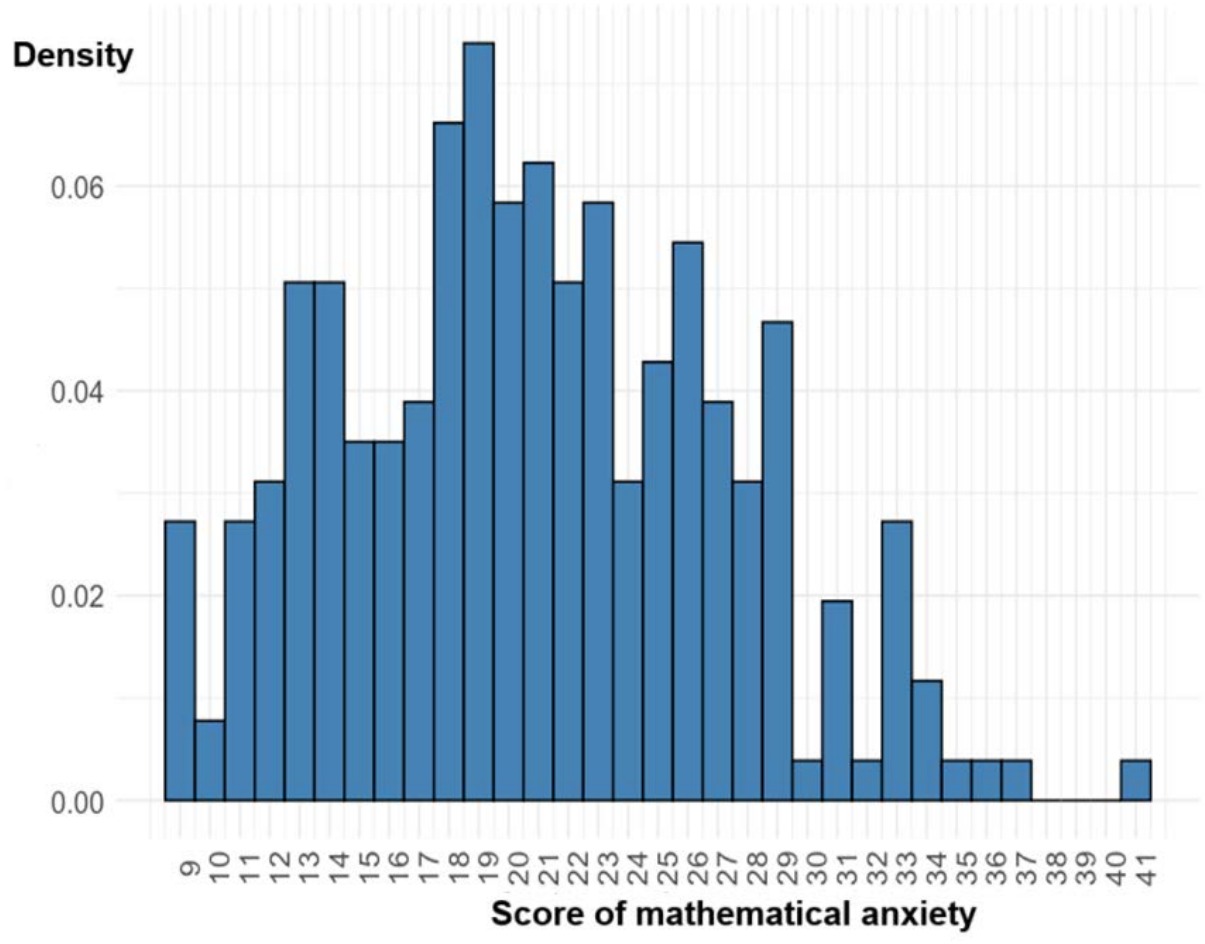

Fig. 1. Histogram of mathematical anxiety

The minimum value of mathematical anxiety in our dataset was 9 (the lowest possible level of mathematical anxiety), and the maximum value was 41. Values of 42–45 (the highest level of anxiety) did not occur. The maximum value of 41, achieved by only one student, can be considered an extreme value in terms of mathematical anxiety, as the scores of other students ranged between 9-37. The average score of mathematical anxiety is 20.86, with a median of 20. The most common score is 19 (19 students, i.e., 7.39 %). From the histogram, we can see that higher scores of mathematical anxiety (35 and above) were achieved by a minimum number of students. Based on these observations from the histogram, it can be assumed that the probability distribution of mathematical anxiety scores will be skewed to the right and will have a heavier right tail. This means that students are generally considered to be less anxious about mathematics.

Relationship between mathematical anxiety and gender

Box plots (see Figure 2) characterize the scores of mathematical anxiety separately for boys and girls. In both populations, the minimum score was 9. The maximum score for boys is 34, which is lower than for girls, whose maximum reached 41. The average values are marked by a dot in the graph and are very similar for both populations. The average score for boys is 20.30 (sd = 6.17), and for girls, it is 21.48 (sd = 6.61). The median values are very close to the averages, being 20 for boys and 21 for girls, and are represented as the center of the box in the box plot. Based on the graph and numerical characteristics, we see that girls' scores tend to be higher than boys'. The edges of the boxes in the box plot are formed by the 25th and 75th percentiles, indicating that the values of mathematical anxiety for girls are slightly higher than for boys.

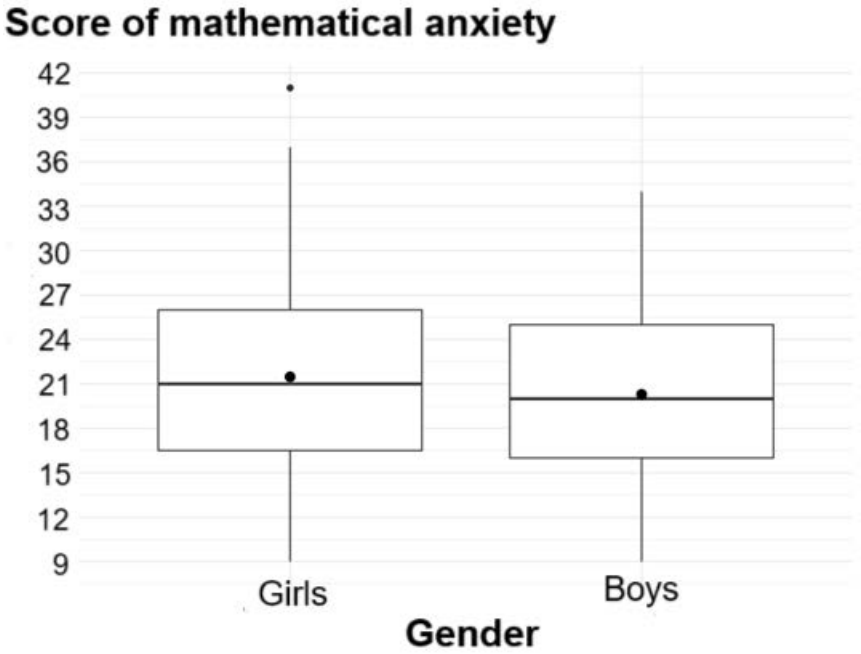

Fig. 2. Box plots of mathematical anxiety by gender

We tested whether there are differences in mathematical anxiety scores between genders at a 5 % significance level using the two-sample Kolmogorov-Smirnov test. The null hypothesis was the equivalence of the distribution functions of the scores for girls and boys, which would mean that the data come from the same probability distribution and therefore do not differ by gender. Justification: The Kolmogorov-Smirnov test was selected due to its non-parametric nature and its suitability for comparing distributions that may differ in both shape and central tendency. Given the right-skewed distribution observed in the histogram, the use of this test was considered more appropriate than the Student's t-test, which assumes normality. The value of the test statistic is D = 0.10, with a corresponding p-value of 0.55. Therefore, at the 5 % significance level, we do not reject the null hypothesis of the equivalence of distribution functions. The data did not show a statistically significant difference between the mathematical anxiety of boys and girls (Osaďan et al., 2022).

3. Conclusion

The aim of this study was to investigate the prevalence of math anxiety among primary age children and to examine the relationship between gender differences and math anxiety in Slovak elementary children. Overall, our results did not record the occurrence of mathematical anxiety in younger school-age children in Slovakia.

This finding suggests the need for further research on mathematical anxiety, focusing on its causes, diagnosis, age categories, and possibilities for its elimination. Our additional finding shows that there was no statistically significant difference in mathematical anxiety between boys and girls in the studied sample. Therefore, gender differences in mathematical anxiety likely do not represent a significant aspect in the studied age category.

Our research findings are consistent with studies (Szczygieł, 2019) that did not find significant differences in the level of mathematical anxiety between boys and girls of younger school age. The similarity of our research findings with the studies of M. Szczygiel with Polish children likely reflects the cultural closeness of the research participants. It can be assumed that the perception of gender, or its socio-cultural understanding in society, is similar in both Polish and Slovak societies. Our research findings suggest that an individual's gender is likely a significant factor in mathematical anxiety, but not the only one. Recent research, therefore, focuses on the socio-cultural aspect of mathematical anxiety. These studies indicate differences in measured mathematical anxiety when comparing participants from different cultures (Brown, 2020). The socio-cultural aspect of mathematical anxiety thus appears to be a factor that plays a significant role in the differences or similarities in mathematical anxiety among participants.

Given that research on mathematical anxiety has not yet been conducted in Slovakia, we could not compare its prevalence or trend among different age categories. Research on mathematical anxiety in children at the upper elementary level and higher age categories could provide results that would complement current knowledge about its development.

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Professional Socialization of Students Using Social Media Tools

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Abstract

The issue of socialization is one of the most important in sociology, psychology, pedagogy, and philosophy. The socialization of university students is an extremely significant process, both for contemporary Russian society as a whole and for the personal development of each future specialist in particular. That is why the study of students' professional socialization through the use of social media tools is intended to help create favorable conditions for the development of well-rounded, physically and psychologically healthy, and spiritually enriched members of society.

The aim of this article was to determine the impact of social media on the professional socialization of students. Using survey methods and mathematical statistics, significant differences were identified between student groups depending on their involvement in professional online communities.

The study revealed that students who are registered in professional and educational groups – i.e., those who use social media tools in the process of professional socialization – are more likely to express a desire to become highly qualified specialists in their chosen field; they consider such qualities as education, professionalism, diligence, perseverance, creativity, and the ability to generate new ideas to be important. These students tend to use effective learning practices and are more oriented toward working in their field of study and engaging in scientific research.

Keywords: socialization, professional socialization, social media, students, motivation, learning practices.

1. Introduction

Today, against the backdrop of changing social functions of professional education institutions, the demands for the quality and content of specialist training, as well as for their

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future social roles and professional fulfillment, are increasing. At the same time, modern production and the labor market require a new type of worker – one who possesses a high level of social competence, professional and psychological adaptability, and mobility (Babina et al., 2022; Gumerova, Shaimieva, 2024). Therefore, the issue of professional development, and especially professional socialization, has become one of the key concerns for both the development of society as a whole and for specific social systems.

This issue is closely linked to the search for new models of organizing the educational process through the use of information and communication technologies, as well as to the creation of an effective environment for quality interaction between teachers and students (Kuznetsov, 2024).

The use of social networks as a platform for learning and communication allows for the organization of students' independent work during non-class hours (Shichkin et al., 2024). Methodologically sound and purposeful integration of online services into the educational process has the potential to foster self-regulated, autonomous learning, since learning via electronic social networks is active, dynamic, student-driven, and student-managed (Klimenko, 2012). In addition, the use of network technology services as modern educational tools helps improve the quality of the educational process, enabling a rapid response to the emerging demands of the information society (Pavlichenko, 2012; Shaimieva et al., 2024; Grudtsina et al., 2025).

The concept of professional socialization emerged under the influence of the general concept of socialization (Severin, 2023). It represents a process through which an individual's mental structures are shaped through interaction with those parts of the social environment that are connected to professional activity (Makarova, 2007; Smolin, Palchikova, 2024). Professional socialization begins during higher education and is largely determined by the conditions of professional training (Seliverstova, 2010; Bulgakova, 2024).

According to Migacheva (2007), socialization into a profession involves acquiring the necessary skills as well as social support (depending on the specifics of the professional activity), through which a sense of belonging to the profession develops. The author also emphasizes that during the socialization process, a professional acquires a new language for understanding and perceiving reality.

Murzagalina (2010) defines professional socialization as the accumulation of professional experience by the subject in the course of their activity. She notes that the foundations of professional socialization are laid during university training.

Researchers view professional socialization as the process of entering a professional environment, internalizing professional experience, and mastering the standards and values of the professional community (Abdullayev et al., 2024a). It is also seen as an active realization of accumulated professional experience, where various types of adaptive behavior are expressed not as a response to external demands but as an autonomous choice of the optimal behavioral strategy, leading to professional self-development (Irba (Kiseleva), 2008).

Krasnoperova (2008) pays particular attention to the concept of "professional and labor socialization." She argues that professional socialization is closely tied to professional functions, without which it cannot be fully realized. During professional socialization, individuals are prepared for professional labor. Therefore, for this preparation to be effective, socialization must be aligned with pedagogically organized labor – this is the essence of professional and labor socialization (Abdullaev, 2023; Zhuzeyev et al., 2024). This type of socialization refers to professional development based on the cultivation of professional qualities, beginning with early vocational education and continuing throughout life through interaction with the surrounding environment. It includes the assimilation of social norms and cultural values, professional self-development, and self-realization in the society to which the individual belongs. It encompasses labor education, vocational training, and the spontaneous acquisition of appropriate qualities (Goncharenko et al., 2025).

A.V. Zenkina (2020) notes that personal activity is essential in the process of professional socialization, as it involves interaction and influence within systems of social connections and relationships, and it demands a whole set of characteristics from the individual. S.G. Razuvaev (2013) suggests that a person with a well-formed "self-concept" and developed motivational-cognitive characteristics will be more successful in undergoing professional socialization. This process involves the individual entering into social relationships with others who belong to a specific professional environment (Shahr et al., 2019; Markheim, Lukyanova, 2023).

Studies also highlight that professional socialization is a multifactorial and multi-level process of acquiring professional culture, integrating into the professional system through the transmission of professional values, traditions, and behavioral norms (Rubanova, 2015; Babina, Utusikov, 2024; Semenova, Lazutova, 2024). The implementation of this process at different stages of life (childhood, adolescence, youth, adulthood, and old age) has its own unique features (Radaev, 2018).

V.A. Klimenko understands professional socialization as a process of human development and self-realization through the assimilation and reproduction of professional culture. Alongside acquiring knowledge, skills, and creative experience in the professional sphere, it also includes behavioral norms, interpersonal relations, and a value system aligned with the purpose and content of the profession (Klimenko, 2012).

Thus, professional socialization can be understood as both the process and outcome of acquiring professional competence – that is, the combination of knowledge, skills, and abilities necessary for effective activity in a given professional field, as obtained through higher education. The key role in this process belongs to the realization of an individual's educational potential, which is an integrative characteristic encompassing one's knowledge, skills, learning needs, interests, values, and motivations shaped by both formal education and self-education (Salisu et al., 2019; Shebzukhova et al., 2023 Mityurnikova et al., 2023).

As for students specifically, professional socialization takes place through real-life interaction under the influence of social circumstances and various educational influences. This shapes their worldview, activity skills, behavioral principles, and psychological qualities, thereby preparing them to participate in public life (Arendachuk, 2013). Amid growing competition in the education sector, the significance of students' professional choices and their drive for self-expression and self-fulfillment has increased (Romm, Romm, 2010).

Researchers note that the student years are a sensitive period for the development of key sociogenic potentials of the individual, including: the formation of professional, ideological, and social qualities of the future specialist (Nizhnikov, Lagunov, 2024); the development of professional abilities as a prerequisite for independent professional creative activity; the formation of intellect and stabilization of character traits; the transformation of motivation and value systems; and the formation of social values in connection with professionalization (Vaisburg, 2014; Abdullayev et al., 2024b). In other words, higher education plays a crucial role in the comprehensive socialization of the student as an individual.

Professional socialization is considered the second stage in the broader process of human socialization. At this stage, individuals acquire a profession and gain specific role-based knowledge, with the role being connected to the division of labor (Morozova, Frolova, 2005). The professional socialization of university students is an especially important process, both for Russian society as a whole and for the development of each future specialist as an individual (Yugfeld, Pankina, 2014; Gazizova et al., 2025).

Therefore, the aim of this article is to determine the influence of social media on the professional socialization of students.

2. Research methodology

To achieve the stated objective, the authors employed a number of methods, most notably: analysis of psychological, pedagogical, and scientific-methodological literature; a questionnaire-based survey (empirical research); and methods of mathematical data processing.

At the first stage of the study, the method of scientific-methodological literature analysis was used to identify key patterns, trends, and characteristics of students' professional socialization. This method enabled a detailed examination of the essence of the professional socialization process and the influence of social media on it.

The survey was conducted during the second semester of the 2023–2024 academic year at the Russian State Agrarian University – Moscow Timiryazev Agricultural Academy. The sample consisted of 50 third-year and 50 fourth-year students. The selection of respondents was carried out using a convenience sampling procedure, since participation in the survey was voluntary and limited to students available at the time of data collection.

The questionnaire offered to the students consisted of two blocks of questions. The first block focused on the use of social media in their professional socialization (2 questions): "Which groups are you registered in or subscribed to?" and "In which groups do you spend more time compared to others?".

The second block addressed the development of professional socialization and included questions about students' motivation for entering university, professionally significant personal qualities, study strategies and practices, motives for academic activity, and the types of work they plan to pursue after graduation (5 questions):

1. What is your motivation for obtaining higher education?
2. Which personal qualities do you consider professionally significant?
3. How do you organize your study activities?
4. What are your motives for academic engagement?
5. What do you plan to do after graduating from university?

For the second block, multiple answers could be selected.

The survey was conducted through an online platform.

Based on the responses to the first block of questions, the student sample was divided into an experimental group (EG) and a control group (CG). The experimental group (EG) consisted of students who were registered (or subscribed) to both professional and educational online groups. The remaining students comprised the control group (CG).

It was hypothesized that being registered in professional and educational groups may indicate the initial stages of professional socialization.

At the third stage, the results from the second block of questions were processed using methods of mathematical statistics. The goal was to identify differences in the distribution of a particular indicator (the formation of professional socialization) by comparing two empirical distributions. For this purpose, Pearson's chi-square test (χ^2) was used.

The measurement scale included two categories ("forming" and "not forming"), hence the degrees of freedom $v = 1$. According to the chi-square distribution table, for a significance level of $\alpha = 0.05$ and $v = 1$, the critical value is $\chi^2\_crit = 3.841$.

The statistical hypotheses of the study were as follows:

– H_0 (null hypothesis): There is no difference between the empirical distributions of EG and CG students regarding the formation of professional socialization.

– H_1 (alternative hypothesis): There is a difference between the empirical distributions of EG and CG students regarding the formation of professional socialization.

3. Research results

3.1. Survey results (first block of questions)

Table 1 shows the types of groups respondents are registered in and in which of those groups they spend the most time.

Table 1. Distribution of responses to the questions: "Which groups are you registered or subscribed to?" and "In which groups do you spend more time than in others?"

Groups	Registered / Subscribed	Spend over an hour
Entertainment	84 %	81 %
Music	84 %	38 %
Informational	70 %	54 %
Educational	58 %	43 %
Political	51 %	3 %
Shopping	51 %	16 %
Professional	51 %	39 %
Commercial	41 %	16 %
Sports	38 %	3 %
Gaming	35 %	24 %
Culinary	32 %	0 %
None	24 %	0 %

Source: compiled based on the survey

It was found that only a quarter of respondents do not belong to any group. The other responses were distributed as follows:

84 % of respondents are in entertainment groups, the same number in music groups, 70 % are in informational groups, and 58 % are in educational groups. Political, professional, and

shopping groups each have 51 % of respondents. Other types of groups account for about one-third of the surveyed students.

Although students can be registered in several groups simultaneously, they spend the most time in entertainment groups. In these, the number of students registered and the number who spend time there is almost equal – about 80 %.

70 % of respondents are registered in informational groups, and 54 % report spending significant time there.

Approximately 40 % of respondents spend a substantial amount of time in professional and educational groups, though nearly two-thirds are registered in them.

While 84 % of respondents are registered in music groups, only 38 % spend much time there. In political groups, where half of the students are registered, only 3 % spend a significant amount of time. In shopping groups, where the same number of students are registered, five times as many (16 %) spend most of their time.

Based on the survey results, the student sample was divided into two groups. The **experimental group (EG)** consisted of students who were simultaneously registered (or subscribed) to both professional and educational groups (46 %). The remaining students formed the **control group (CG).**

3.2. Survey results (second block of questions)

As part of the study, the motivation for entering university was analyzed among the separate student groups.

Table 2. Motivation for higher education (as % of respondents)

	EG	CG	χ^2
Wanted to become a highly qualified specialist in their chosen field	54.7	42.3	12.67*
Wanted to improve their social status, gain a more prestigious position	37.9	36.2	2.54
Wanted to secure financial stability in the future	52.6	51.8	1.19
Believed that any university diploma would be useful in life	34.9	37.3	5.68*
Parents insisted on it	8.2	8.2	0
Thought university would provide interesting social connections	12.2	12.5	0.67
Believed higher education would help them become cultured, well-educated	25.7	27	3.42
Hard to say	1.4	1.5	0.23
Other	0.6	0.7	0.22

Source: based on the survey results (multiple answers allowed).
Note: * $p \leq 0.05$

The leading motivations for entering university were the desire to become a highly qualified specialist in their chosen field, to ensure future financial stability, to improve social status, to obtain a university diploma, and to become a cultured and educated person.

For most answer choices, there were no statistically significant differences between the experimental group (EG) and the control group (CG). However, for the statement "Wanted to become a highly qualified specialist in their chosen field," the χ^2 value exceeded the critical level ($12.67 > 3.841$).

In analyzing students' professional socialization, we also studied their focus on developing qualities such as creativity, conscientiousness, education, professionalism, self-discipline, diligence, perseverance, initiative, critical thinking, and the drive for self-realization.

The study revealed that students generally value qualities such as education, professionalism, diligence, perseverance, creativity, and the ability to innovate.

Statistically significant differences between EG and CG were found for qualities such as creativity, conscientiousness, discipline, education, professionalism, self-discipline, and the desire for self-realization.

Table 3. Students' orientation toward developing professionally significant personal qualities (as % of respondents)

Professionally significant qualities	EG	CG	χ^2
Creative approach, ability to generate new ideas	59.6	39.3	18.91*
Conscientiousness, discipline	37.4	17.2	13.34*
Education, professionalism	48.6	45.5	5.12*
Self-discipline, self-organization	36.6	30.6	8.42*
Diligence	36.4	35.8	1.41
Perseverance	37.2	34.1	2.83
Initiative	33.8	35.7	1.42
Critical thinking	24.7	27.7	3.15
Striving for self-realization and personal achievements	47.5	28.8	11.63*

Source: based on the survey results (multiple answers allowed).
Note: * $p \leq 0.05$

We also examined students' learning practices (see Table 4).

Table 4. Students' learning practices (as % of respondents)

Learning Practices	EG	CG	χ^2
Study to the best of their abilities	65.3	38.7	22.63*
Absorb material with little effort	34.2	36.3	1.42
Study systematically throughout the semester	54.7	40.4	14.31*
Regularly attend and actively participate in classes	43.5	26.9	10.72*
Complete all academic tasks in full	54.3	42.1	10.31*
Go beyond the required program	63.2	23.8	29.81*

Source: based on the survey results (multiple answers allowed).
Note: * $p \leq 0.05$

Significant differences in learning practices were observed between EG and CG. More students in EG reported studying to their full potential, studying systematically throughout the semester, attending all classes regularly, completing all tasks in full, and going beyond the basic program (see Table 4).

To explore students' academic motivation, we analyzed the motives for their academic engagement (see Table 5).

Table 5. Students' academic motivation (as % of respondents)

Academic Motivation	EG	CG	χ^2
Desire to better prepare for a future professional career	75.8	58.7	17.22*
Desire to build a successful career	64.2	66.3	1.23
Considering grades in future employment	44.7	40.4	2.17
Interest in the subjects studied	53.5	26.9	18.42*
Sense of self-worth	34.3	32.1	0.51
Parental control	35.3	37.6	1.64
Grades matter for receiving a scholarship	34.2	36.3	1.42
Demanding teachers	44.7	40.4	1.31

Source: based on the survey results (multiple answers allowed).
Note: * $p \leq 0.05$

The most common academic motivations were the desire to prepare for future professional work, build a career, consider academic performance in future employment, and interest in the subjects studied.

Statistically significant differences between EG and CG ($\chi^2 > \chi^2\_crit$) were found for the motivations "Desire to better prepare for a future professional career" and "Interest in the subjects studied."

An important indicator of professional socialization is students' life plans after graduation (see Table 6).

Table 6. Types of activities students plan to pursue after graduation (as % of respondents)

Post-Graduation Plans	EG	CG	χ^2
Teaching (college, technical school, university)	8.3	7.6	1.91
Scientific research	44.7	16.4	28.72*
Practical work in their field	66.6	34.2	22.11*
Administrative/managerial work	18.2	19.7	1.17
Political or social activity	4.9	5.1	0.81
Starting their own business	24.1	28.3	3.13
No clear plans yet	10.4	24.1	12.52*

Source: based on the survey results (multiple answers allowed).
Note: * $p \leq 0.05$

The results show that after graduation, students are primarily oriented toward working in their field, starting a business, or engaging in administrative work (see Table 6).

Statistically significant differences between EG and CG ($\chi^2 > \chi^2\_crit$) were observed for the following post-graduation plans: "Practical work in their field," "Scientific research," and "No clear plans yet."

Overall, the survey results related to the formation of professional socialization indicate that χ^2 values for most variables exceeded the critical threshold ($\chi^2 > \chi^2\_crit$). This provides a basis to reject the null hypothesis (H_0) and accept the alternative hypothesis (H_1), confirming that the empirical distributions of EG and CG students in terms of professional socialization **differ significantly**.

Therefore, the hypothesis that the professional socialization of students in the experimental and control groups differs has been confirmed.

4. Discussion

Based on the conducted empirical study, it can be concluded that the main factors determining the professional socialization of university students through the use of social media tools are as follows:

– Educational Process Factor: Successful professional socialization is more effective when students integrate social media tools into their learning process.

– Characterological Factor: Personal traits play a crucial role in successful professional socialization. These include creativity, conscientiousness, education, professionalism, self-discipline, diligence, perseverance, initiative, critical thinking, and the drive for self-realization (Akhmetshin et al., 2025).

– Motivational and Value-Based Factor: The student's motivational and value sphere significantly influences professional socialization. This includes the desire to prepare better for a future profession, the ambition to build a professional career, considering academic performance in future employment, and interest in the subjects studied.

– Professional Identity Factor: One of the key components of professional socialization is professional identity, which is formed, among other things, under the influence of social media.

An important factor influencing the effectiveness of future specialists' professional socialization is their commitment to working in their chosen field – something in which social media and participation in profession-oriented groups can play a significant role.

According to Social Learning Theory, students learn better when they can interact with peers within the framework of an academic course or assignment. Research has shown that academic performance is higher among those who were part of a specific social media group that brought like-minded individuals together (Radaev, 2018).

Social networks can also be used in students' research activities, as virtual communities contribute both to the expansion of professional contacts and to a broader inclusion of potential

participants in academic discourse (Arendachuk, 2013; Vassilchenko, 2024). Social media connects people from various professional backgrounds, increasing network diversity and enhancing the circulation and usage of network resources. Furthermore, students can engage in communication and form communities based on various interests – economic, ethical, cultural, intellectual – which often overlap with their professional interests (Serebrennikova, 2024).

Most students and teachers already use social platforms and online social networks in daily life. Free social media tools can meet the needs of educational participants in storing, sharing, and collaborating on various documents. However, the primary factor limiting the active use of these tools is the readiness of the education system to adopt modern teaching technologies (Razuvaev, 2013).

Given the rapid development of computer-based technologies and their integration into the educational process, alongside these advantages, some negative aspects of using social media in education should also be acknowledged. These include limited functionality in finding new friends, rapid habituation to excessive online presence, health deterioration (e.g., vision problems, disrupted sleep patterns due to lack of rest, nervous system disorders), and the fact that communication in virtual networks cannot replace real human interaction and genuine emotional experience.

This study has one limitation: the sample was obtained through convenience sampling from a single university (Russian State Agrarian University – Moscow Timiryazev Agricultural Academy). Therefore, the results may not fully represent the entire student population, and caution should be exercised when generalizing the findings.

5. Conclusion

Social networks, when integrated into the learning process, can become an integral part of a university's information and educational environment. They possess significant educational potential and create fundamentally new channels for information and communication exchange. The use of such an information-educational environment implies that activities within social networks produce tangible outcomes, making voluntary and motivated participation a key element.

Social networks should be viewed not only as entertainment and communication platforms but also as a powerful educational resource – an interactive space that serves as the foundation for innovative learning processes involving modern information technologies. The use of the positive aspects of social media – such as convenience, informativeness, accessibility, informality, and psychological comfort – can help create an effective environment for successful student professional socialization. These platforms can eliminate barriers to education, make the learning process more engaging and non-traditional, and foster a psychologically supportive climate for acquiring knowledge.

Undoubtedly, this form of professional socialization represents the future for students. As one of the most popular services among students, social networks can bring greater mobility, interactivity, accessibility, and creativity to higher education. In turn, this enhances motivation to learn and positively affects the quality of students' cognitive outcomes.

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Factors Influencing Financial Well-being Among High School Students: Do They Differ by Gender?

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Abstract

This research focuses on assessing financial well-being among high school students and exploring any potential differences between male and female students. It uses a quantitative, non-experimental, cross-sectional approach. A total of 556 students, aged 11 to 16, participated in the study. The data was gathered through an online questionnaire, and the sample was based on voluntary participation rather than random selection. The results identified six key factors of financial well-being: 1) Confidence in financial decision-making; 2) Spending control and discipline in saving; 3) Financial security and well-being; 4) Financial burden and lack of control; 5) Financial understanding and seeking guidance; and 6) Financial insecurity and perception of limitations. These findings are consistent with previous studies, such as those by Lusardi and Mitchell (2014), but no significant gender differences were found, which contrasts with other studies that suggest such variations. From a theoretical perspective, this study expands the financial well-being model by including emotional and psychological dimensions. Practically, it suggests that financial education programs for students should address not only technical aspects but also the development of emotional and psychological skills. Furthermore, educational policies should focus on the individual needs of students, regardless of gender. Future research could examine how digital financial education, along with family and sociocultural influences and financial self-efficacy, shapes adolescents' economic decision-making. This study highlights the need for a comprehensive approach to financial education, suggesting that gender differences are not

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particularly significant at this stage. It also emphasizes the importance of exploring these dynamics across diverse socio-economic contexts to gain a deeper understanding.

Keywords: Financial well-being, high school students, financial skills, gender differences, financial education.

1. Introduction

In recent years, academic interest in financial well-being has grown steadily, driven by ongoing economic uncertainty, the fast-paced evolution of digital technologies, and the increasing debt burden among younger generations. Researchers and policymakers alike have started paying closer attention to this issue, recognizing its importance for both personal and broader economic stability. Contemporary research defines financial well-being as a multidimensional concept shaped by various factors, including financial knowledge, personal financial habits, access to financial services, confidence in managing money, and broader social, cultural, and psychological influences. Lusardi and Mitchell (2014) highlight financial literacy as a key foundation for making sound financial choices, and a crucial element in fostering greater financial wellbeing. Later, Xiao, and O'Neill (2016) point out that financial behaviors such as saving regularly and managing debt responsibly, play a direct role in helping individuals reach and maintain long-term financial wellbeing. Even before this, Gutter and Copur (2011) had already stressed the value of financial inclusion and self-efficacy, arguing that people who have access to financial services and feel confident in their ability to handle money are more likely to enjoy a greater sense of financial well-being. In this regard, it is increasingly evident that financial well-being not only depends on individual factors but also on the contextual conditions and the social and economic environment in which individuals develop. Therefore, it becomes relevant to question: What is the current level of financial well-being among high school students? Additionally, is there a gender difference? Based on this context, the study focusses to assess the levels of financial wellbeing among high school students and explore whether any differences exist between male and female students.

2. Literature Review

A growing body of research supports the idea that financial literacy plays a significant role in improving financial well-being. For example, Philippas and Avdoulas (2021) highlight that university students in Greece who demonstrate higher financial literacy – particularly those with parents holding advanced education or who habitually track their expenses – tend to handle unexpected financial difficulties more effectively. Similarly, research by Zhu, Yu, and Chou (2019) in Hong Kong found that while financial education boosts knowledge and attitudes significantly, it doesn't always lead to immediate changes in financial behavior, indicating that these aspects should be seen as distinct. Looking at the bigger picture, Setiyani and Solichatun (2019) in Indonesia revealed that financial literacy, combined with factors like social influences, money attitudes, and financial confidence, has both direct and indirect effects on financial wellbeing, with financial behavior acting as a key link in this relationship.

Gilenko and Chernova (2021) also emphasized the role of literacy but warned about the endogeneity bias in its relationship with savings among adolescents, highlighting the need for robust evaluation methods. In line with this critical view, Frisancho (2020), through a randomized trial in Peru, showed that financial education programs can have limited or even undesirable effects if not carefully designed. On the other hand, Ayuninggar et al. (2024) emphasized that family influence outweighs socio-economic status in the financial literacy of adolescents.

Meanwhile, Saeedi and Nishad (2024) provided a bibliometric view of the field, noting a shift in the conceptualization of financial well-being: from an income and wealth-centered perspective to one that considers behavioral and psychological variables. In this context, Alqam and Hamshari (2024) found that financial literacy, especially which focused on consumer rights, strengthens both financial inclusion and well-being in young Jordanians. Similarly, She, Ma, and Pahlevan (2024) incorporated future orientation as a moderator, showing that this variable enhances the effect of financial knowledge on behavior and, consequently, on well-being.

Studies in emerging contexts have further explored how financial inclusion and digital literacy also play a relevant role. In India, Kamble, Mehta, and Ranin (2024) found that both financial literacy and financial inclusion contribute positively to financial well-being, with financial inclusion having a greater influence. In the workplace, Samuel and Kumar (2024) noted that having a positive financial attitude and access to proper education can improve workers' financial

well-being, while financial stress tends to undermine it. Similarly, Shankar et al. (2022) emphasized that financial behavior stands out as the most significant predictor of well-being among Generation Z students, surpassing even financial knowledge and access to technology.

In the university context, Montalto et al. (2019) emphasized the importance of the educational environment in building financial capabilities, including responsible credit use, self-efficacy, and stress management. However, Robb and Chy (2023) pointed out that short-term courses have limited effects on financial well-being and stress, although they do improve financial socialization. Public policies have also shown positive results in promoting financial well-being. In China, Xie et al. (2020) found that financial support for students living in poverty can improve their well-being, especially when those students are able to move beyond that condition. Early financial education has been examined as well. In the Netherlands, Dare et al. (2020) observed that programs targeting children help develop basic transactional skills, though they found no clear evidence of an impact on responsible spending. On the other hand, longitudinal research such as the study by Cherney et al. (2019) revealed that student debt has a lasting negative effect on subjective financial well-being, particularly when influenced by the socio-economic background of the family.

Other approaches emphasize psychological and cognitive dimensions. Castellanos-Alvarenga et al. (2022) showed that planning and organization, as executive functions, mediate the relationship between subjective knowledge and financial control. At the regional level, studies like that of Russell et al. (2025) in Australia and New Zealand reported high levels of financial stress among university students, affecting their performance and mental health, particularly among low-income and international students. In Latin America, Avendaño, Rueda, and Velasco (2021) found that, despite favorable attitudes, practical weaknesses persist in students' financial management.

On the other hand, Wheeler and Brooks (2024), building on previous work on Marcia's (1966) identity status theory, as well as research by Barber et al. (2011), Bosch et al. (2016), and Sorgente et al. (2020), introduced the concept of financial identity. They found that students with achieved financial identity were better prepared to take on financial responsibilities, while those with identity moratorium experienced greater financial anxiety and lower financial well-being. Furthermore, students with diffuse identity showed poor preparation for assuming financial responsibilities, poorly managed credit, and exhibited higher levels of materialism and compulsive buying. These results suggest that promoting the achievement of financial identity and financial socialization could help emerging adults improve their financial management and reduce financial anxiety.

In India, Bhat et al. (2025) linked digital literacy with lower impulsivity and greater self-control, both of which are predictive of financial well-being. Some works such as those by Obenza et al. (2024) and Glenn et al. (2025) highlighted financial self-efficacy as a key mediating variable between behavior and well-being. Similarly, Limbu and Sato (2019) demonstrated that literacy specific to credit card use, mediated by self-efficacy, improves well-being, particularly when students have fewer cards, thus maintaining greater financial control. Nguyen (2021) observed in Vietnam that attitudes, behaviors, and financial self-confidence exert a direct influence on financial well-being, whereas financial knowledge and skills tend to have a more indirect effect. Meanwhile, qualitative research like the study by Douwes et al. (2023) offers a broader view of student well-being, highlighting the need to balance academic pressures with personal life. Norvilitis and Linn (2021), using a mixed-methods approach, identified that how students perceive debt, experience anxiety, and learn about finances at home are crucial factors affecting their financial well-being. The authors suggest that for interventions to be truly effective, they should address not only individuals but also involve their families.

Method

The study employed a non-experimental, cross-sectional design to examine the factors influencing the relationship between financial literacy and financial well-being. A total of 556 secondary school students, aged 11 to 16, participated in the research. A non-probability, self-selection sampling method was employed, and data were collected through an electronic questionnaire designed in Google Forms, aiming to maximize accessibility and encourage voluntary participation. The test used was composed of three sections: sociodemographic data, items related to financial literacy, and ten items assessing financial well-being, this last component based on the scale developed by the Consumer Financial Protection Bureau (CFPB, 2018). This instrument has been previously applied in García-Santillán et al. (2024).

The study was carried out in compliance with the ethical principles established in the Declaration of Helsinki and received formal approval from the Ethics Committee of the Business School at Universidad Cristóbal Colón (Project ID: P-12/2024). Participants were informed about the purpose of the study at the time of completing the questionnaire. Full confidentiality and anonymity of the information provided were ensured. The questionnaire included an informed consent section, and submission of responses was considered an explicit indication of voluntary participation.

3. Results

Data analysis

To evaluate the dataset's internal consistency and reliability, Cronbach's coefficients was calculated. The results indicated an acceptable level of internal consistency, with a Cronbach's alpha of .609.

Participant Characteristics

The characteristics of the study participants are as follows: 47.8 % (n = 266) were male, 49.5 % (n = 275) were female, and 2.7 % (n = 15) identified as LGBTQ+. The largest percentage of participants were in the 13 to 14-year age range, with 59.4 % (n = 330), followed by 24.6 % (n = 137) in the 11 to 12-year range, 13.7 % (n = 76) in the 15 to 16-year range, and 2.3 % (n = 13) were older than 16 years. Regarding financial influencers, the highest percentage was the mother, with 48.4 % (n = 269), followed by the father at 30.6 % (n = 170). Additionally, 14.4 % (n = 80) reported no one influenced their finances, 4.7 % (n = 26) were influenced by siblings, and 2.0 % (n = 11) by friends. In terms of living situation, the highest percentage lived with their father, accounting for 64 % (n = 356), followed by 29.3 % (n = 163) who lived with family, 4.7 % (n = 26) with others, and 2 % (n = 11) with friends. Regarding the source of income, the highest percentage reported being financially dependent on their parents, with 75 % (n = 417), followed by 8.8 % (n = 49) receiving a scholarship, 6.8 % (n = 38) working, 5.4 % (n = 30) had no income, and 4.0 % (n = 26) received income from siblings.

Bartlett's Test Results

The KMO result reached .782, suggesting suitability for factor analysis. Additionally, Bartlett's test of sphericity was significant, with a Chi-square value of 2032.560 (df = 190, p < .001). The Measure of Sampling Adequacy (MSA) values were all greater than .5, and the correlations were acceptable, with the determinant value close to zero, supporting the factorization (see Tables 2 and 2b). Table 3 shows the total variance explained by six components (55.238 %).

Table 2. Correlations matrix

	FS1	FS2	FS3	FS4	FS5	FS6	FS7	FS8	FS9	FS10	MSA
FS1	1.000										,835a
FS2	0.478	1.000									,840a
FS3	0.501	0.425	1.000								,863a
FS4	0.459	0.430	0.495	1.000							,876a
FS5	0.288	0.218	0.286	0.266	1.000						,784a
FS6	0.253	0.281	0.350	0.281	0.554	1.000					,795a
FS7	0.368	0.337	0.400	0.401	0.409	0.422	1.000				,892a
FS8	0.308	0.258	0.285	0.322	0.332	0.269	0.340	1.000			,834a
FS9	0.217	0.206	0.270	0.234	0.175	0.218	0.348	0.416	1.000		,790[a]
FS10	-0.178	-0.078	-0.077	-0.077	-0.041	-0.032	0.008	0.094	0.165	1.000	,570[a]

Determinant: -6.773E-05

Table 2a. Correlations matrix

	FWB1	FWB2	FWB3	FWB4	FWB5	FWB6	FWB7	FWB8	FWB9	FWB10	MSA
FWB1	1.000										,618[a]
FWB2	0.438	1.000									,653[a]
FWB3	0.181	0.080	1.000								,596[a]

	FWB1	FWB2	FWB3	FWB4	FWB5	FWB6	FWB7	FWB8	FWB9	FWB10	MSA
FWB4	0.308	0.347	-0.038	1.000							,643[a]
FWB5	0.179	0.139	0.244	0.171	1.000						,665[a]
FWB6	-0.010	-0.032	0.128	0.048	0.222	1.000					,568[a]
FWB7	0.019	-0.029	0.104	-0.017	0.078	0.149	1.000				,683[a]
FWB8	0.111	0.079	0.011	0.056	0.058	-0.003	-0.032	1.000			,742[a]
FWB9	0.081	0.000	0.095	0.000	0.051	0.055	0.266	-0.025			,571[a]
FWB10	0.010	0.054	0.123	0.054	0.117	0.079	0.167	0.123	0.273	1.000	,553[a]

Determinant: -6.773E-05

Table 3. Variance explained

	Initial eigenvalues			Sum of squared loadings of the rotation		
Factor	Total	% variance	% accumulate	Total	% de variance	% accumulate
1	3.802	19.009	19.009	2.925	14.623	14.623
2	2.001	10.007	29.016	1.910	9.549	24.172
3	1.628	8.139	37.155	1.824	9.119	33.292
4	1.359	6.797	43.952	1.504	7.518	40.809
5	1.163	5.813	49.765	1.462	7.312	48.122
6	1.095	5.473	55.238	1.423	7.116	55.238

Extraction method: Principal components

Table 4. Rotated component matrix with Varimax rotation

	1	2	3	4	5	6	CR	AVE
FS2	0.777							
FS1	0.760							
FS4	0.731							
FS3	0.692							
FS7								
FS5		0.733						
FS6		0.724						
FWB8								
FWB2			0.776					
FWB1			0.772					
FWB4			0.669				0.777	0.574
FWB9				0.741				
FWB10				0.719				
FWB7				0.575				
FS10					0.740			
FS9					0.584			
FS8								
FWB5						0.680		
FWB6						0.678		
FWB3						0.638		

Notes: Extraction method: Principal component analysis. Rotation method: Varimax with Kaiser Normalization. [a.] The rotation has converged in 7 iterations.

Factor Rotation Results

The results of the factor rotation are shown in Table 4, which displays the rotated matrix using the Varimax rotation method. The analysis results indicate six key factors in the rotated matrix, which reflect various aspects of money management. Factor 1, labeled *Confidence in Financial Decision Making*, involves participants' confidence in their ability to handle new or complex financial challenges, recognize valuable investment opportunities, and meet their financial goals. Factor 2, named *Spending Control and Saving Discipline*, involves the skill to resist unnecessary expenses and consistently save money. On the other hand, Factor 3, *Financial Security and Well-being*, reflects the sense of stability in the face of unforeseen circumstances, future planning, and the ability to enjoy life due to good money management.

In contrast, Factor 4, *Financial Burden and Lack of Control*, highlights situations where finances cause stress, are disorganized, or are affected by even small extraordinary expenses. Factor 5, titled *Understanding and Seeking Guidance*, addresses the difficulty in understanding financial information and recognizing when financial advice is needed. Finally, Factor 6, related to *Financial Insecurity and Perception of Limitations*, reflects a sense of economic vulnerability, worries about depleting financial resources, and the belief that, given the current circumstances, the individual may be unable to reach certain personal goals or aspirations.

Table 5. Rotated component matrix [a]

	F1	F2	F3	F4	F5	F6
FS2	.771					
FS1	.764					
FS4	.744					
FS3	.714					
FS7	.535					
FS8						
FWB2		.775				
FWB1		.773				
FWB4		.669				
FS5			.708			
FS6			.695			
FWB8						
FWB9				.743		
FWB10				.713		
FWB7				.580		
FS10					.752	
FS9					.564	
FWB5						.680
FWB6						.680
FWB3						.637

Notes: Extraction method: Principal component analysis. Rotation method: Quartimax with Kaiser normalization. a. The rotation has converged in 7 iterations.

In the confirmatory analysis, Factor 5, which includes items FS10 and FS9, does not show values in the standardized estimates (Figure 1), and therefore are excluded from the analysis. The adjusted model is shown in Figure 2.

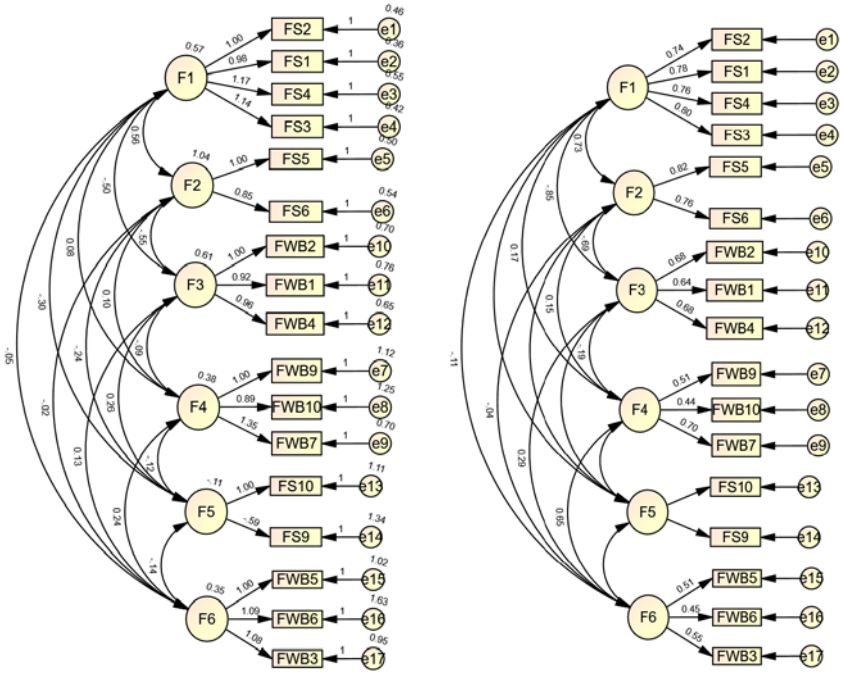

Fig. 1. Initial model of the underlying structure (unstandardized and standardized estimates)

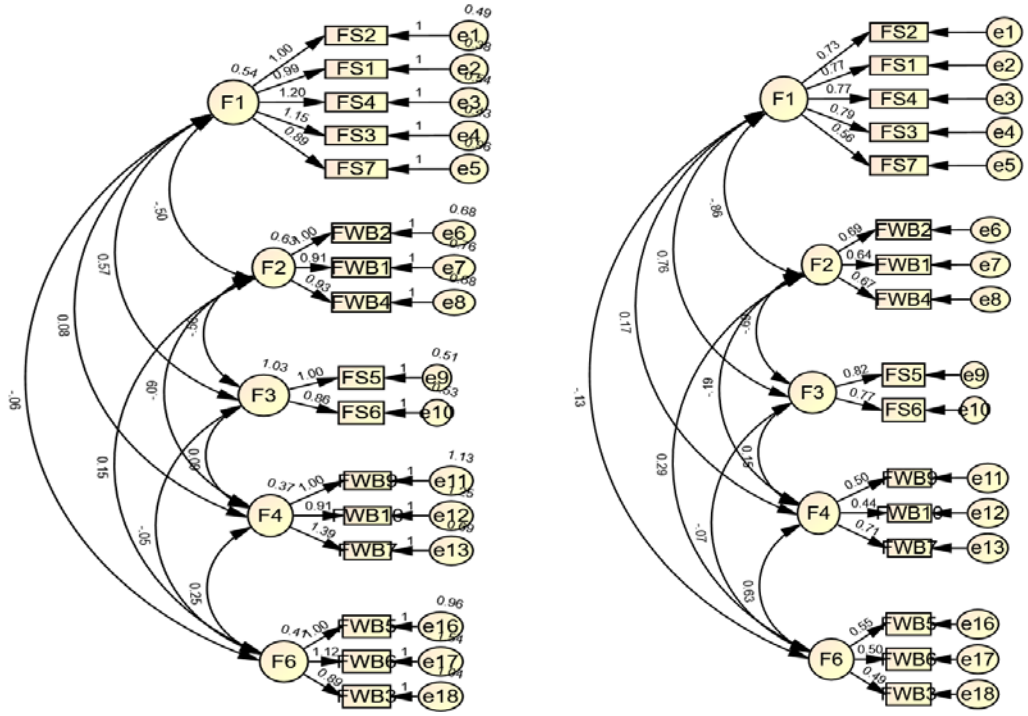

Fig. 2. Final adjusted model of financial well-being

In the study on the perception of well-being and personal financial management, five fundamental factors are identified that help to understand how people experience and cope with their economic reality.

Factor 1: Ability to make informed financial decisions includes skills related to feeling confident when facing new or complex financial situations, recognizing good investment opportunities, meeting personal financial goals, and knowing where to seek reliable financial guidance. Factor 2: Financial stability and well-being is associated with a sense of economic security, the ability to handle unexpected expenses, and the possibility of enjoying life thanks to responsible money management. Factor 3: Discipline in money management refers to the self-control required to prevent unnecessary expenses and to consistently maintain saving habits as part of deliberate financial planning. Factor 4:

Financial overload and lack of control describes a situation where individuals feel overwhelmed by their finances, believe that their money problems dominate their lives, and view social financial obligations as a heavy burden. Finally, Factor 5: Financial insecurity and sense of stagnation expresses a critical situation where individuals barely manage to survive, constantly worry about long-term financial insufficiency, and feel limited in achieving their life goals due to their current economic situation.

Following the refinement of the measurement model, the finalized version was achieved (see Figure 1), demonstrating strong structural coherence, adequate model fit, and adherence to the principle of parsimony, as supported by established theoretical guidelines. In terms of absolute fit, incremental fit and parsimony fit, several indicators confirm the model's adequacy (see Table 6).

Table 6. Summary index

Fit Type	Index	Value	Recommended Threshold	Interpretation
Absolute Fit	χ^2/df	1.54	Between 2 and 5	Acceptable fit
	RMSEA	0.052	≤ 0.06	Good approximation
	GFI	0.919	≥ 0.90	Adequate
	AGFI	0.883	≥ 0.80	Satisfactory
	RMR	0.094	≤ 0.08 (ideal)	Marginally acceptable
Incremental Fit	NFI	0.868	≥ 0.90	Slightly below ideal
	CFI	0.948	≥ 0.90	Strong fit
	TLI	0.934	≥ 0.90	Strong fit
Parsimony Fit	PGFI	0.635	≥ 0.50	Acceptable
	PNFI	0.68	≥ 0.50	Acceptable
	PCFI	0.743	≥ 0.50	Acceptable

As we can see, in Table 6 shows the model meets most of the conventional thresholds for goodness of fit, which indicate that the specified structural model is both adequate and parsimonious. While some indices are slightly below optimal levels, the overall results support the model's validity and suitability for the proposed analysis.

ANOVA

To answer the question about the existence of a difference by gender, the following hypothesis is established: $\mathbf{H_0}$: There is no significant difference between the means of the two groups. $\mathbf{H_1}$: There is a significant difference between the means of the two groups.

$$Ho: m_1 = m_2$$

$$Ha: m_1 \neq m_2$$

Now, it is important to determine whether there is homogeneity of variances before conducting the ANOVA. To verify this assumption, Levene's test is performed. This is necessary because ANOVA assumes that the groups have similar variances (Table 7).

Levene's test was applied to evaluate the assumption of homogeneity of variances between the groups based on gender. The result yielded a p-value greater than 0.05 in 19 out of the 20 items, indicating that there are no significant differences in variances. Therefore, the assumption of homoscedasticity is met, and it is appropriate to proceed with an analysis of variance (ANOVA).

Table 7. Levene test homogeneity of variances

		Levene statistic	df1	df2	p-value.
FS1	It is based on the mean	0.243	2	553	0.79
FS2	It is based on the mean	0	2	553	1
FS3	It is based on the mean	2.107	2	553	0.12
FS4	It is based on the mean	3.445	2	**553**	**0.03**
FS5	It is based on the mean	1.138	2	553	0.32
FS6	It is based on the mean	0.262	2	553	0.77
FS7	It is based on the mean	0.207	2	553	0.81
FS8	It is based on the mean	0.449	2	553	0.64
FS9	It is based on the mean	0.778	2	553	0.46
FS10	It is based on the mean	0.33	2	553	0.72
FWB1	It is based on the mean	1.041	2	553	0.35
FWB2	It is based on the mean	1.016	2	553	0.36
FWB3	It is based on the mean	0.877	2	553	0.42
FWB4	It is based on the mean	0.832	2	553	0.44
FWB5	It is based on the mean	0.849	2	553	0.43
FWB6	It is based on the mean	0.16	2	553	0.85
FWB7	It is based on the mean	2.156	2	553	0.12
FWB8	It is based on the mean	2.756	2	553	0.06
FWB9	It is based on the mean	1.558	2	553	0.21
FWB10	It is based on the mean	0.796	2	553	0.45

Subsequently, an ANOVA test was conducted to compare the means of the variables *financial well-being* and *financial ability* between men and women. The analysis yielded a p-value greater than 0.05 in 18 out of the 20 items, indicating that no statistically significant differences were found in the means between gender groups (see Table 8).

Table 8. ANOVA

		Sum of squares	dfl	Mean square	F	p-value
FS1	between groups	8.334	2	4.167	**3.644**	**0.027**
FS2	between groups	2.11	2	1.055	0.864	0.422
FS3	between groups	0.807	2	0.404	0.302	0.74
FS4	between groups	6.8	2	3.4	2.395	0.092
FS5	between groups	0.829	2	0.415	0.234	0.792
FS6	between groups	1.721	2	0.861	0.539	0.584
FS7	between groups	0.441	2	0.22	0.135	0.874
FS8	between groups	2.714	2	1.357	1.058	0.348
FS9	between groups	0.036	2	0.018	0.013	0.987
FS10	between groups	1.95	2	0.975	0.727	0.484
FWB1	between groups	5.9	2	2.95	2.097	0.124

		Sum of squares	dfl	Mean square	F	p-value
FWB2	between groups	1.668	2	0.834	0.595	0.552
FWB3	between groups	1.027	2	0.514	0.246	0.782
FWB4	between groups	1.075	2	0.538	0.378	0.685
FWB5	between groups	10.016	2	5.008	2.997	0.051
FWB6	between groups	2.87	2	1.435	0.655	0.52
FWB7	between groups	1.748	2	0.874	0.522	0.594
FWB8	between groups	3.487	2	1.744	1.152	0.317
FWB9	between groups	12.784	2	6.392	**3.72**	**0.025**
FWB10	between groups	2.349	2	1.174	0.674	0.51

The results of the ANOVA indicate that, for the majority of variables, there is insufficient evidence to reject the null hypothesis, as their p-values exceed the 0.05 significance threshold. This suggests that there are no statistically significant differences across groups for most factors. However, two variables – FS1 (p = 0.027) and FWB9 (p = 0.025) – did show significant between-group differences. Additionally, FWB5 (p = 0.051) may be considered marginally significant, warranting further exploration.

4. Discussion

The results obtained in this study on the financial well-being of high school students align in several respects with previous findings in the literature. For example, Factor 1: Confidence in Financial Decision-Making highlights the ability to handle complex financial situations, recognize valuable investment opportunities and reach financial goals, aligning with the arguments exposes by Lusardi and Mitchell (2014), whose refers that financial literacy is crucial for informed decision-making. Similarly, Setiyani and Solichatun (2019) also emphasize the importance of financial confidence and behavior in achieving adequate financial well-being, which is reflected in the inclusion of this factor in the study. Factor 2: Spending Control and Saving Discipline, this reflects the ability to avoid excessive spending and maintain a habit of saving, characteristics that Xiao and O'Neill (2016) also underline as fundamental for achieving financial sustainability. However, this study shows that this factor is more relevant than others in the context of high school students, possibly reflecting an earlier stage in the development of financial habits compared to young adults in other studies. Regarding Factor 3: Security and Financial Well-Being, the results are consistent with the conclusions of Frisancho (2020) and Castellanos-Alvarenga et al. (2022), who consider financial well-being to be related not only to economic stability but also to the ability to enjoy life, rather than focusing solely on the accumulation of resources.

In the Factor 4: Financial Burden and Lack of Control reflects a state of financial stress and disorganization, which is also supported by studies such as Russell et al. (2025), who identified high levels of financial stress among university students – affecting both academic performance and mental health. However, the context in this study focuses more on concerns among high school students who have not yet faced heavy debt situations. Factor 5: Understanding and Seeking Guidance refers to the difficulty in understanding financial information and the need for external guidance, aligning with studies by Zhu et al. (2019) and Gilenko and Chernova (2021), who point out that while financial education can improve knowledge, financial behavior changes more slowly and often requires additional support. Finally, Factor 6: Financial Insecurity and Perceived Limitation reflects a sense of economic vulnerability and the belief that financial constraints prevent individuals from achieving their goals. This is consistent with the findings of She et al. (2024), who note that concern for the future and unmet goals can negatively affect financial well-being.

This outcome differs from previous research that has identified gender-related differences. For instance, Xiao and O'Neill (2016) argue that financial behavior may vary between men and women depending on cultural and social contexts. In contrast, the present findings suggest that, within the sampled high school population, financial literacy and skills appear to be comparable

across genders. This may imply that such differences, if they exist, do not become pronounced until later stages of adulthood – highlighting the need for further investigation in future studies.

This analysis shows that although many of the findings align with the literature, there are also areas of divergence, particularly in the lack of clear gender differences and the prominence of certain factors, such as saving discipline, among younger students. These patterns may reflect the specific characteristics of the study group.

Theoretical and Practical Implications. The theoretical and practical implications of this study are significant for both understanding financial well-being and implementing educational strategies and public policies. From a theoretical perspective, the results expand the traditional model of financial well-being by identifying six key factors that encompass not only cognitive and behavioral aspects – such as financial decision-making and spending control – but also emotional and psychological dimensions, such as financial security and perceived economic insecurity. This enriches existing theories, like those proposed by Lusardi and Mitchell (2014), by incorporating variables that have been less explored in previous research. Moreover, the study prompts a reflection on the influence of gender on financial well-being. In contrast to previous studies that suggest significant differences between men and women, no notable variations were found in this research. This finding could encourage a reconsideration of theories that assume predominant gender differences in financial management, suggesting that in specific contexts – such as among high school students – these differences may not be as relevant.

In terms of practical implications, the results highlight the need for financial education programs at the high school level to adopt a more holistic approach. Rather than focusing solely on technical aspects of money management, these programs should also nurture students' emotional and psychological capacities, as well, building confidence in financial decision-making and encouraging the discipline needed for consistent saving. Moreover, the findings underscore the importance of implementing public policies that offer both financial and educational support, especially for students in vulnerable conditions. Such measures could play a crucial role in alleviating perceived financial insecurity among this population. Finally, the study's findings suggest that intervention strategies should not be solely based on gender differences but rather tailored to the individual needs of each student, regardless of their sex. This underscores the need to revise current financial education policies to make them more inclusive and responsive to the diverse contexts and experiences that characterize today's youth.

5. Conclusion

The study emphasizes the complex and multidimensional nature of financial well-being among high school students, identifying essential components such as confidence in financial decision-making, effective control over spending, and the perception of economic security. Despite expectations of gender-based differences, the results suggest that there are no significant variations between male and female students in terms of financial well-being and skills. This presents an opportunity to reconsider current approaches that assume more pronounced gender differences. Furthermore, the study underscores the importance of addressing both cognitive and emotional components in financial education programs to improve students' money management capabilities.

Suggestions for Future Research. Examine the effects of digital financial education on the financial wellbeing of young individuals. Additionally, analyze how family dynamics and sociocultural factors contribute to shaping the financial wellbeing of high school students. Study the role of financial self-efficacy in economic decision-making during adolescence. Finally, expand the analysis to different socioeconomic contexts to assess whether the conclusions regarding gender remain consistent across diverse populations.

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Prevention of Children's Adaptation Difficulties in Primary Education through early Stimulation of School Readiness

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Abstract

The presented article is devoted to the issue of preventing adaptation difficulties of beginning schoolchildren by strengthening school readiness at the end of pre-primary education in kindergarten and in elementary school. Specifically, it concerns the stimulation of universal learning prerequisites, which are considered by experts to be one of the essential determinants of initial learning. With this intention, our own set of activities was developed, which is oriented towards optimizing the conditions in the transition period and developing the learning prerequisites of children for school education. In order to verify their effectiveness, a pedagogical experiment was carried out at selected primary schools in Slovakia. The experiment confirmed that the proposed set of activities had a statistically significant effect on the level of learning prerequisites of children at the beginning of schooling. We can consider the strengthening of individual areas (e.g. memory, school motivation, planning, understanding of instructions, etc.) as one of the important components of preparing children for a successful start to school and preventing adaptation difficulties.

Keywords: transition period, kindergarten, initial learning, school readiness, components of school readiness, adaptation difficulties, prevention, learning prerequisites

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1. Introduction

Providing timely care and education to children from birth to the start of compulsory school attendance is an important part of preventing their developmental delay as well as school immaturity. In 2022, the National Strategy for the Development of Coordinated Early Intervention and Early Care Services 2022–2030 was adopted in Slovakia. One of the long-term goals of this strategy is the creation of a system of multi-level support for the optimal development of children and the elimination of inequalities between them in accordance with their current health, development and social needs. The proposed system of interdepartmental cooperation is intended to ensure adequate conditions for supporting the complex development and social inclusion of children through the so-called universal interventions that create an inclusive environment in healthcare, education and the social sphere.

Part of the above-mentioned goals in the field of education is also the creation of conditions to support school readiness and the smooth transition of children from kindergarten and family to elementary school. This transition represents a significant change in a child's life with an impact on his/her academic and personal development (Gonzalez-Moreira et al., 2023; Bakopoulou, 2022; Tokic, Borovac 2020; Viskovic, Višnjić-Jevtić, 2020). Prevention or elimination of difficulties faced by some children when entering primary school requires targeted and effective cooperation between the family and school environment in an effort to saturate their individual needs (Tobin et al., 2022; Packer et al. 2020). First of all, it concerns their readiness for the tasks of school education, but also the readiness of schools and teachers to support children of diverse groups in gradual adaptation to new conditions. A significant role in this is played by the targeted preparation for the future position of the schoolchild at the end of pre-primary education in kindergarten and in the family, when attention gradually shifts from play to work with structured activities led by adults (Wildres, Wood, 2023). The content of these activities is the gradual familiarization of future schoolchildren with new perspectives of school education. It also includes the stimulation of prerequisites for future learning activities, which gradually become the main activity of the beginning pupil.

Research show that early support already in kindergarten is one of the determinants of a successful transition to elementary school and a student's academic success (Quenzer-Alfred et al., 2020). Similarly (e.g. Gagay, Grineva, 2015, Dockett et al., 2011; Lillejord et al., 2015, Urbina-Garcia, 2020; Supporting successful..., 2020) emphasize the positive impact of stimulating a child's cognitive, social and psychomotor skills before entering primary school. A child's lack of readiness for new changes is one of the most frequently cited causes of problematic adaptation (Hurrelman, Bründel, 2003; Martin, 2013 and others). We consider the support of children's readiness for schooling to be one of the effective strategies for a smooth transition to the next level of education and the prevention or elimination of adaptation difficulties. This means implementing concrete measures aimed at preventing undesirable phenomena in our case of adaptation difficulties.

According to E. Leonov et al. (2014), insufficient development of universal learning prerequisites, as one of the components of school readiness, is identified as one of the fundamental causes of students' academic failure and problematic adaptation to school. The aim of this study is to verify the effectiveness of a set of activities focused on stimulating learning prerequisites in children during the transitional period between pre-primary and primary education.

Review of the literature

Currently, a holistic approach to the issue of school readiness, which looks at this phenomenon from the point of view of the child's individual competencies, is being emphasized. They are part of the developing personality of the future schoolchild - emotional-value, content-active and control-regulatory competences (Zhao, 2017). The unifying beginning of all components of the future pupils´ personal readiness is the awareness and emotional experience of their growing "maturity", which manifests itself in independence and a focus on a new social position, i.e., in the center of the future pupil´s perception is the emerging subjective position in activity, communication and learning.

A similar concept is shared by E. Leonova et al. (2014), which emphasizes the importance of personal competence as an integral characteristic of the future schoolchild's personality. Its structure consists of: an individual-psychological component (personality specifics, its individuality, e.g. the child's self-evaluation), an intellectual component (the level of the child's intellectual abilities and knowledge), a motivational-value component (school motivation – relation to knowledge, curiosity,

etc.), communicative component (the ability to establish contact with peers and adults) and the activity component - a certain level of universal learning activities (prerequisites for learning, e.g. the ability to understand and accept the teacher's instructions, to plan the course of activities (3-5 procedures), to be able to perform self-control in accordance with specified procedures, prerequisites for self-evaluation according to specified criteria) (Figure 1). Nevertheless, in pedagogical practice, the abilities of future schoolchildren to acquire the basics of literacy in primary education (reading, writing, mathematical skills, etc.) are dominantly developed.

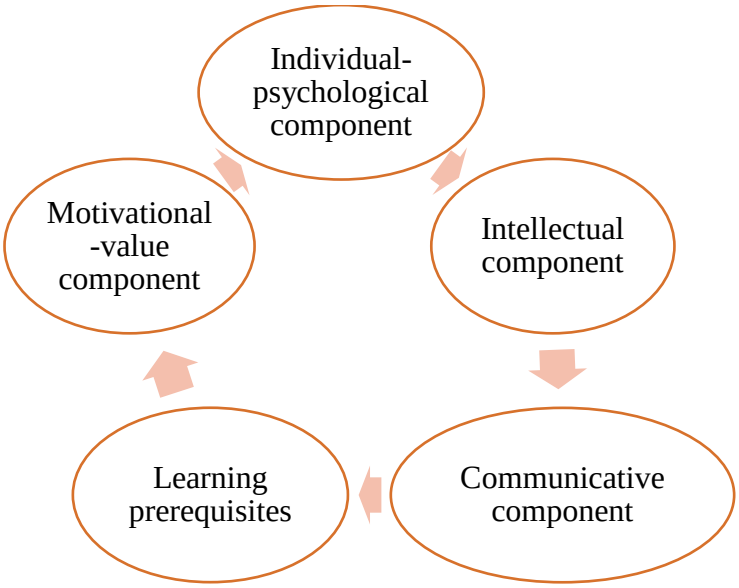

Fig. 1. Concept E. Leonova et al. (2014)

Even though the positive impact of children's school readiness before starting compulsory school attendance on their academic and personal development is confirmed, professional discussions about its validity continue. On the one hand, we can observe tendencies that emphasize the need for children's pre-specified academic and social skills. On the other hand, some authors emphasize the policy of inclusive education with an emphasis on the readiness of the school to create an environment in accordance with the diverse individual educational requirements of children (Petriwskij, 2010). This approach extends and questions the concepts of readiness, which emphasize a narrow focus on pre-specific sets of skills, individual performance tasks and testing (Falchi, Friedman, 2015).

Another issue is the establishment of indicators of children's school readiness, which would enable those involved to orientate themselves at their level and take appropriate intervention measures in time. A lot of researches confirm that primary and kindergarten teachers, including parents of future/starting school children, often have different views on children, their learning process and the role of the teacher (Einarsdóttir, 2018; Fabian, Dunlop, 2007). Kindergarten teachers in many cases consider other aspects of school competence to be important and prioritize them than teachers in the 1st grade. Some experts (Hansen, 2012) are critical of the insufficient theoretical and practical understanding of the structure of children's school readiness as well as the focus of preventive measures and practical solutions to emerging adaptation difficulties at the threshold of school attendance.

If we start from the theory of the overall development of the child's personality, the main indicator of the personality readiness of the future schoolchild is the forming subjective position in activities, communication and cognition. Its essence consists of initial key competencies. A child with a high level of initial competence is able to independently solve tasks aimed at protecting his/her health, to carry out diverse types of activities (play, productive, learning-exploratory, communicative, etc.), to cooperate with adults and peers. It also includes developing ideas about oneself, the intentionality of cognitive processes, etc. (Brocki, Bohlin, 2004). Initial key competences are indicators of school readiness and a starting point for the preparation of future schoolchildren in kindergarten with the aim of leveling their starting abilities when transitioning to school, humanizing initial teaching (the concept of child well-being) and creating a unified training system.

In our article, we focused more closely on the activity component of personal readiness – on universal learning skills. The child develops learning skills gradually in initial teaching in joint activities with the teacher, but the prerequisites for them are already formed in preschool age. The point is that the learning activity, which becomes the main activity after the child starts school, presupposes, among other things, his/her readiness for a subjective position in this activity. The subjective position is understood as the sum of such abilities as e.g., social activity of the child, which is aimed at acquiring and expanding certain knowledge and the ability to apply it in practical activities, a certain level of cognitive interests, a focus on independent, creative work, achieving good academic results, etc. The ability to work according to a certain pattern, the ability to listen to and complete the instruction of an adult, to control one's activity, to be able to evaluate one's own work and the work of others according to specified criteria can be included among other learning skills of a beginning schoolchild (Garon, 2008).

For some children, as a result of the increased burden caused by the changes related to starting school, the problematic integration into the unfamiliar environment and the emergence of adaptation difficulties might occur (Borbélyová, 2020). The causes relate to both endogenous factors (Crepaldi Santos et al., 2017) and exogenous factors associated with the family, preschool and school environment (Rimm-Kaufman, Pianta, 2000; Boethel, 2004; Marturano, 2008; Akcinar, 2013). One of the most frequently cited causes of problematic adaptation is the insufficient level of comprehensive readiness for school (Hurrelman, Bründel, 2003; Denham, 2006). An insufficiently developed level of readiness, including the educational prerequisites emphasized by us, can be a serious obstacle in the gradual identification of the child with the role of a schoolchild, as a result of which the process of adaptation takes on a problematic character.

The results of experiments, e.g., also prove this (Józsa et al., 2023). According to the authors, the riskiest area in adapting to school was the students' intellectual passivity. Here, teachers recorded serious symptoms that indicated potential problems in this area. 25 children (23.58 %) did not know how to navigate the tasks, did not know how to perform the task according to the teacher's instructions. Furthermore, it was observed that 35 students (33.01 %) often did not answer essential things, could not capture the essence. 38 pupils (35.84 %) had difficulty understanding the teacher's instructions, they did not understand various concepts. From the above, it can be deduced that the students did not have sufficiently developed learning habits.

Singer, Bashir (1999) confirm that one of the main causes of school failure of pupils is insufficiently developed executive functions, which represent a set of higher cognitive processes. Through them, the individual can regulate his/her behavior (flexible goal-oriented behavior such as activation – the ability to complete tasks, adequate ability to concentrate, direct attention to task performance, working memory, adequate management of frustration and control of emotions, ability to self-regulate one's behavior, etc.).

Effective preventive measures include preparing the future schoolchild to accept a new role, the result of which is his/her school readiness. Prerequisites for the above-mentioned abilities are created throughout the child's stay in kindergarten. Targeted preparation for their development is mainly implemented at the end of pre-primary education in the class of the oldest children – future schoolchildren through purposefully directed activities under the guidance of the teacher. The new quality of their development continues in school education. Deliberately directed activities are considered the beginning of a child's intellectual work, through which his interest and need to learn about the world and discover new facts is formed. The child gradually learns to set a goal, to choose adequate means, to be aware of the work progress and, above all, to achieve a certain result. It is important that the teacher's cooperation with "preschoolers" is carried out in the spirit of partnership. The teacher acts as a partner who establishes contact with the child, but also with the object of their joint activity, which he plans, manages, coordinates, and analyzes. In the process of partnership common activity, there is a constant exchange of information, relationships, and activities between participants. It is important that the participants in the joint activity are comfortable, and that the child's needs are met, aimed at cooperation with an adult (Zakharova, 2022).

When creating our own proposal for preparing children for their future role, we were mainly based on the "concept of the future" (Lago, 2014). Focusing on the future already at the end of pre-primary education represents the child's gradual orientation towards accepting the new social role of pupil and classmate – i.e., adequate preparation for related changes (physical environment, social contacts, learning activities, etc.). The author (2014) places more emphasis on the "after" dimension than on the "before", i.e., involved sides have realistic ideas about the future in primary

school. The educational process is oriented towards the perspective of the future position of children and the resulting learning activity at school as something attractive and desirable.

The transition itself means the end of one part, or level of education and the beginning of the next part of the educational process. The introduction of school education includes a gradual familiarization with the school environment, within which support is needed in the pupil's orientation in new conditions. It also includes longer-term monitoring of the child's progress and the provision of necessary support based on identified stimuli (The transition..., 2001). There is a mutual connection between the individual stages, and the quality of the previous stage determines the quality of the next one.

The theoretical framework of the issue and the research findings so far represented a starting point for conducting pedagogical research, the aim of which was to verify the effectiveness of the set of activities proposed by us at the level of learning prerequisites at the beginning of schooling.

We set a research problem for the research activity: *What is the impact of a set of activities on the level of learning prerequisites of children?*

Subsequently, we defined the research hypothesis H1: The set of activities that we designed has the potential to increase the level of children's learning prerequisites.

Characteristics of the set of activities and methodology of working with it

The set that we compiled contains 10 activities that are aimed at supporting the learning prerequisites of future and beginning schoolchildren, with the aim of reducing their adaptation difficulties. The set of activities is divided into three parts according to target groups and implementation environment. The first part consists of activities aimed at strengthening the learning prerequisites of future schoolchildren in kindergarten. The second part is intended for families with children, the implementation of which is limited to the summer vacation period. The third part is concretized by a set of activities for beginning schoolchildren after entering the 1st year of elementary school. Activities in the individual parts of the compiled set can be carried out separately or in blocks.

The proposed set is primarily aimed at developing children's ability to understand the teacher's instructions, to plan their activities in accordance with the given instruction from the teacher, to create an idea of the result. Secondary, the set is aimed at the development of self-control and self-evaluation of children according to established criteria. The development of the mentioned skills prepares the child for a subjective position in future learning activities, which is an important and determining part of school readiness.

The implementation of a set of activities took place in individual months and institutions:

– May-June (kindergarten and family),

– July-August (family),

– September-October (primary school and family).

Due to the scope of the article, we present only a brief description of the set of proposed activities. In the kindergarten, under the guidance of a trained teacher, a set of four activities was implemented:

– WHAT IF

Objective: To create an idea of expected behavior in selected school situations with an emphasis on self-regulation of behavior.

Aids: pictures depicting school situations (accepting help and praise from a classmate, asking for help, apologizing, cursing, lying, making fun of a classmate)

Implementation: The teacher has prepared pictures with different forms of behavior, e.g., accepting help and praise from a classmate, asking for help, apologizing, asking for advice. The pictures also show inappropriate behavior and situations from school life – cursing, lying, making fun of a classmate, negative evaluation, acceptance of success and failure. He conducts a conversation with the children about the consequences of given situations, about the advantages and disadvantages of the solutions proposed by them.

Output: After mutual conversations with the children and evaluation of selected situations, the children develop ideas about appropriate and inappropriate behavior in the school environment, and their consequences. At the same time, they strengthen their ability to self-regulate.

– DICE

Objective: To apply mental effort in the analysis and comparison of selected subjects from the school environment.

Aids: some dice with pictures of school tools (pencil, scissors, notebook, school bag, pencil case, ruler) (Figure 2).

Fig. 2. Dice with pictures of school tools

Implementation: The teacher demonstrates some dice with pictures. The children's task is to identify school supplies in pictures, verbally describe their use and the necessity for learning at school. Children roll the dice in the specified order and complete other items necessary for the implementation of learning activities. Together with the teacher, they determine different and common features, name objects with superior terms and look for mutual connections between them. When throwing the same object, they have to come up with other possibilities for its alternative use at school.

Outcome: Based on their own experiences and ideas, children improve the mental operations of analysis and comparison.

– DRAWING ACCORDING TO THE INSTRUCTIONS

Objective: To strengthen the ability to understand the given instructions.

Aids: any picture, an album of pictures showing the progress of the activity

Implementation: The teacher divides the children into groups with the same number of members. Each group realizes a different activity. One group draws a picture according to the teacher's verbal instructions. The second group works according to the pictorial procedure. By mutual agreement, the members in the third group draw one common picture. After finishing the activity, the groups take turns. The created image in the third group will be used to formulate drawing instructions in the first group. Within a certain time limit, all the groups will take turns.

Output: The teacher conducts a conversation about the importance of understanding instructions in school education, children create ideas about the potential consequences and causes of not understanding instructions.

– USE OF ITEMS

Objective: To improve the ability to cooperate in a group.

Aids: any objects from the school environment

Implementation: The teacher divides the children into groups with the same number of members. In the formed groups, the children choose the objects that are hidden under the blanket. Together they invent a situation from the school environment in which they will use the selected subjects. Subsequently, they dramatize the given situation in groups. All groups have the same time and the same number of aids for preparation. At the end, both the children and the teacher give feedback on the preparation of the dramatization, the use of objects and the cooperation in the group.

Outcome: Children strengthen their skills in cooperation with other members of the group.

The continuation was the implementation of two activities in the child's family environment during the summer holidays:

– TO SCHOOL – board game

Objective: To strengthen the ability to follow the sequence of steps in solving tasks.

Aids: game plan (Figure 3), dice with numbers.

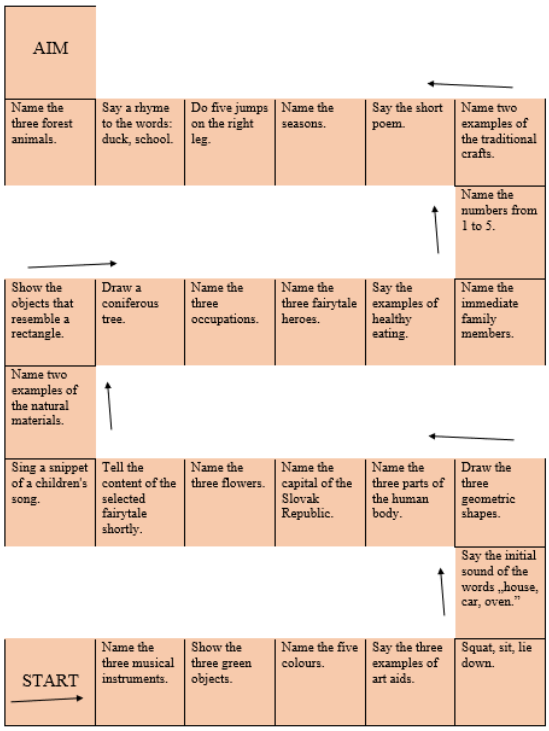

Fig. 3. Game plan

Implementation: The basic element of the activity is the game plan - a path on which there are various tasks. In the specified order, the child rolls some dice with numbers. The parent reads the instruction. The instructions follow from the content of pre-primary education, e.g., name three musical instruments, say the initial sound of words, draw geometric figures, give examples of healthy food, do five jumps on the right leg, sing a song excerpt, etc. After completing the task, the child moves the number of squares thrown on the game board towards the goal.

Outcome: Children are led to improve their ability to understand instructions.

– WHAT WILL I BRING?

Objective: To strengthen the ability to remember the instruction for the activity.

Aids: board (Figure 4).

	colour	1	2	3	4	5
A	blue	art aid	clothes	sports aid	toy	bathroom object
B	yellow	sports aid	favourite object	school aid	clothes	decoration
C	green	clothes	decoration	school aid	art aid	sports aid
D	red	decoration	clothes	sports aid	favourite object	school aid
E	black	shoes	school aid	kitchen object	furniture	clothes
F	white	furniture	bathroom object	art aid	toy	food

Fig. 4. Board

Implementation: The parent formulates the instruction according to the orientation on the board, i.e., combination of color and object (e.g., blue art tool). The child must remember the

instruction. His/her task is to find and bring the object according to the instructions based on the prepared chart. In the rows there is a color (blue, yellow, green, red, black, white) and in the columns there are objects (clothing, art aid, sports aid, decoration, toy, etc.). A parent can gradually formulate several instructions at once.

Output: The child improves in understanding the instructions and especially in memorizing them. The difficulty increases with the number of instructions.

The third stage began after the children entered the 1st year of primary school, where they continued to implement four activities:

– WHAT THE PUPIL NEEDS FOR SCHOOL

Objective: To strengthen the ability to plan an activity and create ideas about its outcome.

Aids: information resources, art supplies

Implementation: At the beginning of the activity, the teacher asks the question: "What does the pupil need for school?" and talks to the children about their ideas.

The implementation of the activity takes place using the DICVR method according to the authors Zelina & Zelinová (2011) (define, inform, create, verify, implement).

In groups, children think about what a pupil needs for school education:

D-define – together they clarify the importance of school needs for the learning of a pupil in the 1st year of elementary school.

I-inform – children work in groups, look at various encyclopedias, books, newspapers, and with the help of the teacher they can use the Internet.

C-creature. In this part of the activity, they create a set of things that the pupil needs for school. They can draw them or write according to individual assumptions.

V-verify. The created lists of individual groups are compared and evaluated according to criteria – financial costs, necessity, durability, etc. Based on the evaluations, they will select the best list of things, or create a common set of subjects for the needs of school learning.

R-realize. The children will use the processed designs when creating a picture package of school supplies. They individually draw a specific thing from the list on a separate piece of paper. They collect all the pictures in an envelope as an answer to the question of the future pupil.

At the end, they compare the set of images with their aids.

Output: In children, the ability to plan an activity and create ideas about its outcome is dominantly developed. In the activity, the ability to concentrate and to motivate the activity are also improved.

– CONCEPT MAP – LEARNING

Goal: To deepen school motivation and emotional experience of the role of a pupil.

Aids: none

Implementation: In a common conversation with the teacher, children express their ideas, knowledge and experiences with the term "learning". Recommended questions are: "What are you most looking forward to at school? Which subjects are the most interesting?, What are you worried about while learning?, What have you already learned?". Subsequently, children in groups create a concept map that will contain their answers in mutual contexts.

Output: Children's cognitive motives for learning activities are strengthened, the level of school motivation and adequate emotional experience of the role of a pupil is increased.

– THE WAY TO SCHOOL

Objective: To strengthen the ability to complete the activity.

Aids: construction set, twine

Implementation: The teacher divides the children into groups with the same number of members. Children will create a school environment from the kit, which includes various objects, e.g., shop, bank, post office, bus stop, etc. They will place the completed structures on an open area (carpet, connected school desks). The task of the individual will be to create a path using twine. The teacher determines the beginning and end of the path, e.g., from the school to the post office. Children also propose and implement their own solutions to a given situation. In the activity, everyone takes turns with their own assignment. The difficulty of the task can be increased by setting restrictions on creating a path, e.g., the shortest option. At the end of the activity, they individually draw a map of the way from their residence to the school with a display of dominant objects.

Output: Children improve in completing the activity.

– CONTEXT

Goal: To strengthen the ability to concentrate in activities.

Aids: an album of pictures with school supplies

Implementation: Children look at an album of pictures prepared by the teacher, which show school supplies. Each child will have their chosen picture pinned to their back. His task is to find a teammate with the same picture. Searching for pairs takes place only through non-verbal communication. After finishing the activity, they will evaluate the correctness of forming pairs.

Variation: Individuals can recognize their own image and form groups according to established criteria, e.g., the group was to be created by everyone who had pictures of school supplies, school furniture, people from school, etc.

Outcome: The child practices the ability to concentrate and pay attention.

2. Materials and methods

The formation of universal learning activities is one of the determinants of adopting the role of a schoolchild and successfully managing the resulting changes (dominance of learning activities instead of play, compulsory homework, replacing spontaneous activities with controlled tasks). Even if they are gradually created in primary education, some skills must be developed already in pre-primary education, e.g., understand and accept the teacher's instructions, plan activities, do a self-check in accordance with the specified procedures and self-evaluation according to the specified criteria. (Goleman, D. In: Bednárová, Šmardová, 2012).

Characteristics of the research sample

The research was conducted in two kindergartens and two primary schools. For the purposes of the study, the selection was carried out using convenience sampling. The subsequent criterion for the purposive selection of research subjects was that the child attended a selected kindergarten as a future first-grade pupil and then entered the first grade at a selected primary school. In each institution, two classes of future first-grade pupils in the kindergarten and subsequently two classes of beginning first-grade pupils in the primary school were selected. The research sample consisted of 85 respondents aged 5-7 years, who were randomly divided into an experimental group (44 respondents) and a control group (41 respondents).

Individual groups (experimental and control) worked in the same time intervals and in similar material conditions. The set of activities became part of the educational process of the experimental group as a determined experimental variable. The educational process of the respondents of the control group took place as standard, without any intervention from the researchers. With the respondents of the experimental group, the activities of the 1st part of the set of activities were carried out in kindergarten, then the 2nd part of the activities was presented to the parents, and at the beginning of school attendance they continued with the application of the 3rd part.

Research progress and methods of obtaining new data.

In accordance with the ethical principles of research, the principals of selected kindergartens and elementary schools were asked to carry out the research activity, and we informed them about our research intentions. After the approval of the school management, instructional meetings were held with the teachers who worked with the experimental group of children and pupils. The legal representatives of the children expressed their consent to the research activity by signing the informed consent.

The application of a set of activities in the oldest age group (6-year-olds) of kindergarten began with enrollment in primary school, when contact with parents and "soft" diagnosis of the level of development of the future schoolchild was ensured (in our conditions, it is in the month of April). The first stage of the work represented the implementation of an entry measurement (pretest), the purpose of which was to determine the initial level of learning prerequisites of all children in the research sample. Subsequently, the interested parties (kindergarten teachers, future schoolchildren and their parents) participated in the implementation of activities according to the prepared content and scope. The trained teacher gradually included the activities and carried them out with the students in the teaching process. Due to the local context, some activities were also carried out in the summer months during the school holidays (July, August). This process also included methodical activities for teachers and advisory activities for parents to work with a set of activities. After the implementation of the activities, the output measurement (posttest) was carried out. The intention was to verify the effectiveness of the set of activities designed by us at the level of learning prerequisites at the beginning of school attendance.

As part of a natural (field) experiment, we chose a questionnaire from a number of exploratory methods as the main method of registration and data collection, which was used to map the level of learning prerequisites of each child. His/her choice corresponded to the characteristics of the learning prerequisites, the research sample, the established research purpose (research problem, research goal, verification of hypotheses) and the conditions of pedagogical practice.

To determine the level of learning prerequisites (pretest and posttest), we chose the Childhood Executive Functioning Inventory questionnaire. The original research instrument used was created by Thorell & Nyberg (2008). It serves for teachers to measure the performance functioning (interplay of the organization of activities and thinking) of children from 4 to 12 years of age. Individual questions related to partial cognitive functions necessary for the implementation of future learning activities, e.g., the ability to remember, the ability to elementary plan and complete an activity, understanding instructions, knowing the sequence of steps to solve a task, etc.

The modified questionnaire contained 24 questions, which were divided into several areas revealing the level of partial cognitive functions, i.e., the child's prerequisites for carrying out learning activities at school. The first area of questions concerned working memory, the level of ability to remember information (e.g., “Does he have difficulty remembering long instructions?”; “When asked to do several things, does he remember only the first or the last?”). In the second area, the formation of the skill of elementary activity planning was investigated (e.g., Does he have difficulty planning an activity?", Does he tend to do things without first thinking about what might happen?"). A group of questions in the third area monitored the level of concentration and understanding of instructions (e.g., "Does he have difficulty understanding verbal instructions without visual demonstration?"; "When something needs to be done, is he often distracted by something more interesting?"). The questions of the fourth area concerned the child's activation, organizing tasks, setting priorities and mastering the sequence of steps in solving a task (e.g., "Does he have difficulty with tasks or activities that involve multiple steps?"; "Does he have difficulty thinking ahead or learning from experience?") . The fifth area of questions involves emotionality, the appropriate expression of emotions (e.g., “Does he have difficulty holding back laughter in inappropriate situations? “Does he get overly excited when something special is going to happen?”). In the last area, the level of monitoring, self-regulation in the activity and the ability to finish the activity were determined (e.g., "Does he have difficulty finishing the activity despite the challenge?").

The questionnaire was filled in as follows. If the teacher observed a certain behavior in the child that was characterized by the given question, he/she assigned the child an answer on the scale: completely false (1), false (2), partially true (3), true (4), completely true (5) . The maximum number of points was 120 points. Based on the total number of points, the level of learning prerequisites for each child was examined. Achieving a higher total of points in the questionnaire meant potential difficulties in the implementation of learning activities, i.e., a lower level of performance functioning of the child.

An interview was also used as the research method, which was conducted by teachers of kindergarten, 1st year of elementary school and parents of respondents of the experimental group. We conducted the interview after completing the application of individual parts of the set of activities and after evaluating the questionnaires. The data obtained from the interviews gave us the opportunity to gain a deeper understanding of the various levels of effectiveness of individual activities. For the research activity, we chose a semi-structured interview, the content of which was focused on the positives and negatives of the activities carried out. Other questions arose continuously, related to other contexts according to the content of the teachers' and parents' answers. The interview resulted in answers that we continuously recorded, then transcribed and analyzed.

Data analysis

We tested both in the pre-test and in the post-test

H_0: There is no difference in the level of learning prerequisites between the control and experimental groups,

against

H1: There is a difference in the level of learning prerequisites between the control and experimental groups.

A) Analysis of pre-test results

The aim of the pre-test was to determine the initial level of learning prerequisites of children in the experimental and control groups. The sum of the points in the entry questionnaire was

calculated for each respondent of the control and experimental groups. In each group, the average values were then determined from the total points and the total differences in the level of learning prerequisites were compared. The average number of points was 68 points in the experimental group, 69 points in the control group. In the next step of the pre-test analysis, we tested whether the detected differences in CG and EXG are statistically significant.

According to the results of the Shapiro-Wilk test (Markechová et al., 2011), we cannot consider the distribution of values in individual groups to be normal. Therefore, to verify whether the differences are statistically significant, we used the non-parametric Wilcoxon two-sample non-parametric statistical method. After entering the results of the pretest into the STATISTICS 10 program, we obtained the value of the test criterion Z = 0.688 and p-value = 0.492 in the computer output. The calculated p-value is a large number ($p > 0.05$) we cannot reject the tested hypothesis H_0. The differences between the control and experimental groups in the results obtained in the pre-test are not significant, i.e., there is no statistically significant difference in the level of learning prerequisites between the experimental and control groups. Based on the test, we consider both groups to be equivalent.

B) Post-test analysis

In the post-test, the respondents of the experimental group scored an average of 44 points and the respondents of the control group scored an average of 63.5 points. As in the pre-test as well as in the post-test, we tested the statistical significance of the detected differences between EXG and CG.

Based on the results of the Shapiro-Wilk test (Markechová et al., 2011), we cannot consider the distribution of values in the individual groups to be normal even in the post-test. Therefore, to verify whether the differences are statistically significant, we again used the non-parametric Wilcoxon two-sample non-parametric statistical method.

After entering the results of the post-test, we obtained the value of the test criterion Z = 7.878 and the p-value =0.0001 in the output report of the computer. p- value is a small number, ($p < 0.05$) so we can reject the tested hypothesis H_0. The differences between the experimental and control groups according to the results obtained in the posttest are statistically significant. Based on the differences between the experimental and control groups in the post-test results, we can state that the respondents of the experimental group achieved a statistically significantly higher level of learning prerequisites compared to the respondents of the control group. Therefore, we can consider the proposed set of activities to be effective.

A comparison of the results of the experimental and control groups in the input (pretest) and output (posttest) is shown in Figure 5.

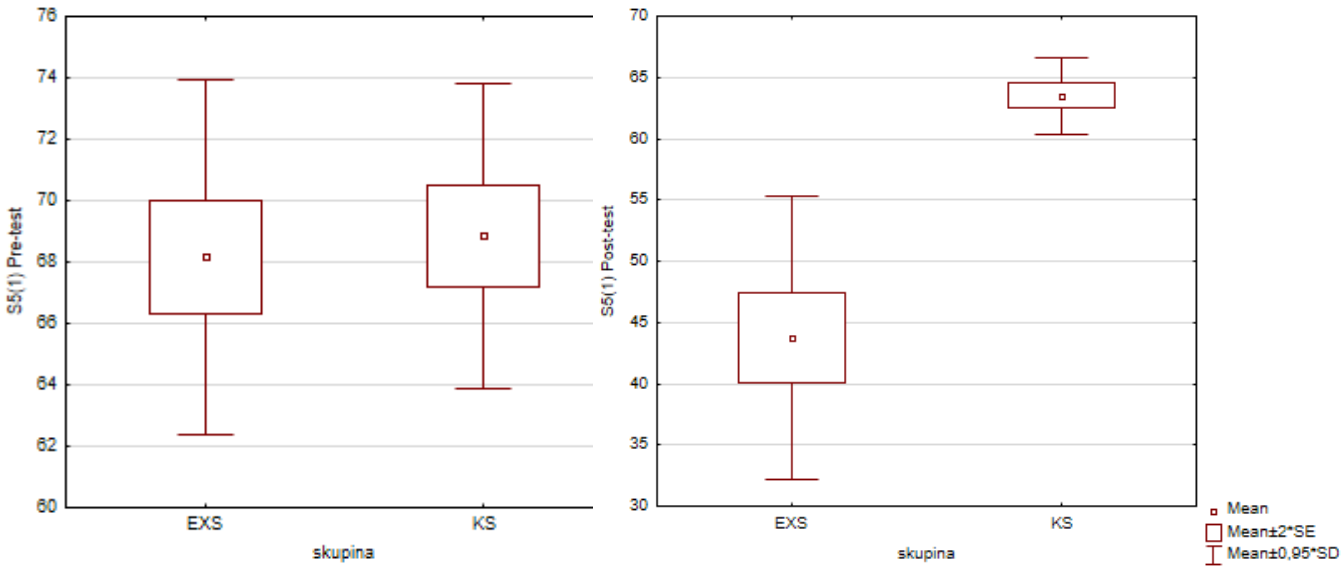

Fig. 5. Comparison of average values between the experimental and control groups in the input (pretest) and output (posttest) measurements

C) Analysis of the effectiveness of activities in individual areas of learning prerequisites

Each of the proposed activities was created in such a way as to specifically develop one of the sub-areas of the children's learning prerequisites. Therefore, the next step of the data analysis was to verify the extent to which the activity develops the area for which it is intended for development. We did this verification in two stages. First, we used the χ^2-test of independence for the $k \times m$ contingency table to verify whether the pupil in the monitored area (Memory, Planning, ...) depends on whether it is the results of the pupil of the experimental group in the pre-test or in the post-test. The calculated values of the test statistics are in table 1. The mentioned test proved (on the basis of the calculated p-value) that there is a connection between the child's results in the pre-test and the post-test in all monitored areas of learning prerequisites. Based on the established relationship, we conclude that the activities are well set, and the higher level of learning prerequisites found in the post-test is a consequence of their application in EXG.

In the next step of the effectiveness analysis of the activities, we calculated the degree of dependence between the children's results in the pre-test and post-test for individual areas of learning prerequisites using the contingency coefficient. The calculated contingency coefficients are in Table 1.

Table 1. Contingency coefficients

Area of learning prerequisites	Pearson Chi-square	Contingency Coefficient C
Memory	30.82	0.5013
Planning	27.709	0.5093
Metacognitive skills	21.011	0.3986
Concentration	26.401	0.4804
Understanding instructions	29.985	0.4844
Sequence of steps	21.054	0.4394
Emotions, school motivation	39.586	0.557
Self regulation	22.094	0.4709
Task completion	12.927	0.3579
Cooperation	21.387	0.4324

Based on the calculated contingency coefficients (Table 1), we note that a moderate to significant degree of connection was identified between the child's results in pre-test and post-test, i.e., the activities created by us developed all monitored areas of learning prerequisites, but not equally.

Table 1 shows that in the areas of "Memory", "Planning" and "Emotions, school motivation" a significant degree of connection was found between the child's results in the pre-test and post-test. Figure X illustrates the change in the distribution of the frequency of points in the area "Emotions, school motivation", where the highest value of the contingency coefficient was calculated (Figure 6).

We interpret this finding as confirmation of the correct setting of the "Dice" and "Road to School" activities, the primary goal of which was to develop these three areas of the child's learning prerequisites. On the contrary, the lowest degree of attachment was found in the areas of "Metacognitive skills" and "Completion of the task", which we interpret as revealing the need to modify the activities "The Cube" and "The Road to School", which were primarily aimed at developing these areas of learning prerequisites. Figure X illustrates the change in the division of points number in the "Task Completion" area, where the highest value of the contingency coefficient was calculated (Figure 7).

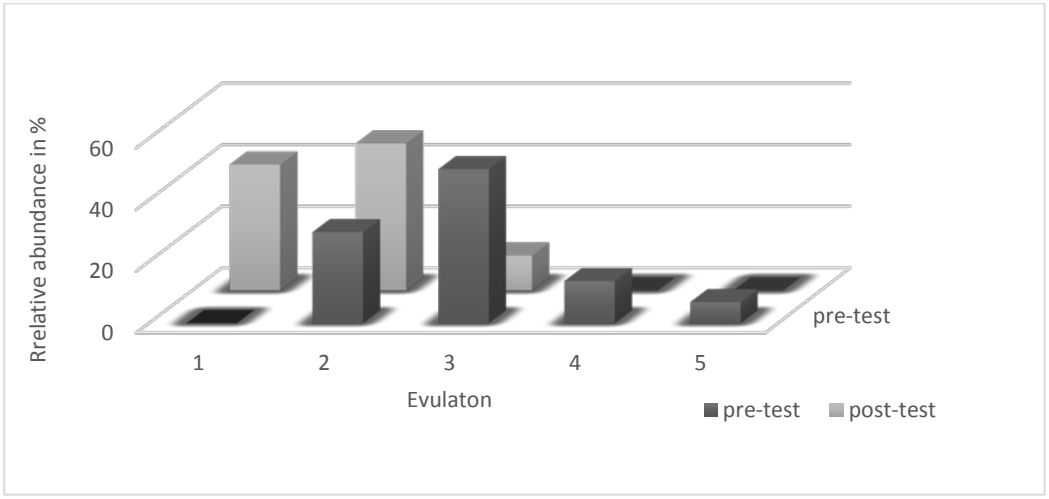

Fig. 6. Division of the children number according to results in the field of "Emotions, school motivation" (in %)

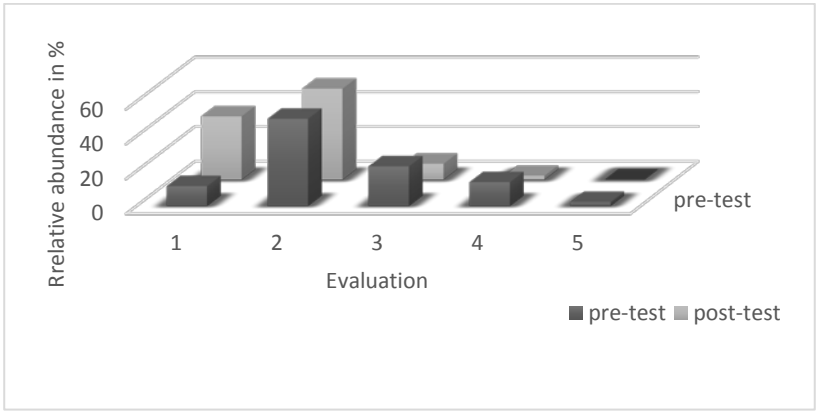

Fig. 7. Division of children number according to the results in the area "Completion of the task" (in %)

D) Interview analysis

The data from the interviews gave us feedback on the different level of effectiveness of individual activities from the perspective of teachers and parents.

According to the teachers, one of the positive aspects of the activities was the formation of children's ideas about future learning activities at school. The activities were mostly easy to work with because the children knew the pictures of school supplies. The tasks were adequate to the children's capabilities, understandable and interesting. The findings confirmed the selected statements of the teachers: "In the activities, there was room to express ideas about life at school and also to develop the creativity of children, who were able to propose alternative uses of selected subjects at school." In the teachers' answers, there were often opinions about activities aimed at strengthening school motivation. Children expressed their own expectations and emotions associated with acquiring new knowledge and skills. The teachers mentioned some of the children's reactions: "I will learn to read and write, then I will be able to read a fairy tale myself" and "I will be smart, I want good grades in the student book."

The intention of the interview analysis was also to reveal the reasons for the lower efficiency of the selected activities.

According to the teachers, some of the activities required mental operations that the children could not handle. Some activities consisted of several tasks. It was challenging for the kids to stay focused and complete them. During the implementation of the activities, the teachers had to repeat the instructions several times and guide the children's activities. The teachers' opinions are illustrated by the statement: *"In my opinion, this activity was difficult in terms of the children's age characteristics. It was difficult for the children, because they had to analyze and compare,*

which they still cannot handle at this age. I would rather divide the activity so that the students can complete it."

It was clear from the interview that the teachers appreciated the initial training to carry out the activities and ongoing methodical support. The teachers said that thanks to the instruction on the activities, they knew how to work with them. At the same time, they expressed they are often looking for some activities, but sometimes their description is unclear. It was summed up more precisely by the teacher, who said that "*during the training, I received all the information about the activities - what I should do with the children, what the activities are aimed at, what to watch out for, what to notice. Methodical support and security were important to me."*

Parents' opinions mainly included positive feedback on activities for children. They managed their implementation in the home environment without difficulty. On the part of the parents, it was necessary to familiarize themselves with the tasks in advance and create the conditions. Comments of one of the parents: *"It was very interesting to observe how my child coped with the tasks."*

3. Discussion

The analysis confirmed that the range of changes in terms of point difference between individual measurements was more pronounced in the experimental group (decrease of 24 points) than in the control group (by 5.5 points). This means that in the experimental group, as a result of our set of activities, the selected abilities of the respondents were strengthened (e.g. children's ability to understand the teacher's instructions, plan activities in accordance with the given instruction, create an idea of the result, the ability to self-regulate, etc.), which helped to form assumptions to future learning skills. The respondents of the experimental group had a four times higher drop in points than the respondents of the control group in the output measurement. A lower number of points predicts a higher readiness of children in the field of learning prerequisites, which belong to one of the indicators of the pupil's school readiness and the formation of his/her subjective position in future learning activities. Its importance is confirmed by several authors (Boethel, 2004; Yuksel et al. 2013; Birken, 2019), who point to the connection between the level of school motivation, willpower and coping with difficulties and obstacles in school situations. Based on our research, we conclude that the implementation of activities aimed at individual areas of children's learning prerequisites reduces the risk of adaptation problems of first-year elementary school students to the school environment. It is the insufficient level of readiness of beginning schoolchildren for school that is the most common cause of children's adaptation problems (Margetts, 2002; Hurrelman, Bründel, 2003; Niesel, Griebel, 2005; Ahtolaa et al. 2011; Dockett, Perry et al. 2011; Borbélyová et al, 2018 and others). Our research indicates that one of the possibilities for solving this problem is the creation of suitable activities aimed at increasing the level of the child's readiness for school.

The formation of the child's prerequisites for the implementation of learning activities at school is one of the important determinants of the gradual identification with the role of a pupil. According to Zhao (2017), raising the cognitive level is an essential part of pre-primary education. The activities were designed in such a way that the children's attention gradually shifts from the game to the schoolwork led by the teacher. According to the teachers' statements in the interview, the children accepted this gradual change and actively participated in the activities. This confirmed the recommendations (Wildres, Wood, 2023) that children in preschool age not only play, but also engage in adult-directed activities. Therefore, to increase the effect of the activities, we also involved parents in their application. In the activities, children's skills, necessary for school education, were gradually developed.

At the same time, the values of the contingency coefficient for individual learning prerequisites in table 1 show different degrees of connection between the activity and its influence on the development of the given area of learning prerequisites. We calculated a moderate degree of coupling in the areas of "metacognitive skills" and "task completion". We can interpret this finding as identifying the need to modify the "Cube" and "Road to School" activities, supplement them or implement them multiple times. The teacher expressed a specific suggestion: "Children's volitional effort is gradually formed, so the activity would require multiple repetitions." The stated findings indicate the need to formulate clear instructions for teachers to carry out selected activities. Several expressions of the teachers related to the difficulty of understanding the tasks: "Sometimes I wasn't sure what the children were supposed to do in the activity." Thanks to the feedback from the teachers, which was obtained through interviews, it is possible to gain a deeper understanding of

the information that results from the statistical analysis of the quantitative data. It is the close cooperation of researchers with teachers in practice that can contribute to the creation of really high-quality and well-targeted activities that will help develop the necessary competencies in children and pupils (Sepehrinia, Mehdizadeh, 2018).

The results of the statistical analysis show a significant degree of connection between activities and the development of children's ability to plan their activities. Among the respondents of the experimental group, there was a significant shift in school motivation, which we consider a positive effect of the inclusion of activities as a whole. It turns out that the partial replacement of games with teacher-led activities creates an interest in school in children, which internally motivates them to learn about an unfamiliar environment. The established connection is also confirmed by the statements of female teachers in the 1st year of elementary school. According to their statements, they observed an increased interest in school among the pupils, which was manifested by the fact that the pupils enthusiastically talked about the new skills they acquired at school. Another of the benefits of the activities as a whole, which emerged from the interviews with the teachers, was the children's increased ability to establish social relationships and the desire to be a good pupil. In the experimental group, there were only a few children with a negative perception of school, which preschoolers pick up from their surroundings, especially older siblings (Dockett et al. 2017; Henderson & Mapp, 2002). The above results show that the children's own experience with the school, which is mediated by suitable activities in the kindergarten, can reduce their negative attitude before entering the school grounds.

We consider the set of activities to be inspiring for pre-primary and primary education teachers' own work. We see the benefit in the possibility of processing them, focusing on the formation of children's learning assumptions, and subsequently in the process of verifying effectiveness through mathematical and statistical methods. Similarly, professional literature (Hansen et al., 2012) emphasizes the need for intervention in the preparation of the child to enter formal education. Teachers can include intentional activities to strengthen readiness, improve emotional and cognitive aspects. However, current research (Nicholas et al., 2021) points to the development and preparation of a child for school in accordance with his potential. The implemented activities should be based on a combination of standardized requirements and an individual approach, which would enable the teacher to support future schoolchildren in developing the necessary skills.

Psychological research (Fredrickson, 2001; Matthews, 2008) proves that forming a positive image of near future, of school, of future learning activities, of rules, of relationships will help children to create a positive image of the future, reduce tension, fear of new. This concept also implies the main task of preparing children at the end of pre-primary education in kindergarten and in the family.

Based on the summarized results of the experiment, we would like to note that we consider the benefits of the application of a set of activities, among others:

– Systematic and purposeful stimulation of the level of learning prerequisites of children at the end of pre-primary education and at the beginning of primary education;

– Early focus on future and beginning schoolchildren in order to prevent, or eliminate the occurrence of adaptation difficulties at the beginning of schooling;

– Teamwork of all involved (teachers, parents, educators);

– Its flexibility – it is available to teachers and teachers can adapt it or be inspired when creating their own programs.

The findings of this study highlight the positive potential of targeted stimulation of learning prerequisites in the preschool period and, at the same time, open up avenues for further research focused on the long-term effects of such interventions on children's academic success after entering primary education. Future studies would benefit from longitudinal research aimed at tracking the persistence of observed effects over time, particularly in relation to the development of reading and mathematical literacy, school adaptation, and self-regulatory abilities.

We also recommend paying attention to the variability in the effectiveness of interventions with respect to individual characteristics of children, such as cognitive maturity, language competence, learning motivation, and social skills. Equally important is the consideration of contextual factors within the school environment, including the quality of teacher-child interactions, family support, organizational and material conditions in the classroom, and the nature of teaching methods and pedagogical approaches.

A more comprehensive understanding of these interrelations can contribute to the more effective design of educational interventions and support an inclusive approach to developing learning prerequisites in children from diverse backgrounds.

4. Conclusion

In conclusion, we can state that the application of a set of activities has managed to significantly increase the level of pupils' learning prerequisites. At the same time, it is important to note that the application of the transition program monitored the potential passing of the occurrence of pupils' adaptation difficulties. A set of activities designed by us and experimentally verified can significantly help a child's smooth transition to elementary school and successful adaptation. The set of activities became a research-confirmed concretization of the support of learning prerequisites, while parents and teachers of pre-primary and primary education actively participated in its implementation. We are aware that currently the emphasis is on strengthening the inclusive approach already in the initial education of pupils. The intention is to level the skill level of beginning schoolchildren to ensure a successful start to school education. The entry of children into the first year of primary school is a challenging period that requires the solution of a full range of questions on both a theoretical and practical level. In the given period, the pupil's school path is intensively created, which presupposes purposeful stimulation of his personal readiness and the application of support strategies from the family, kindergarten and primary school.

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Motivating the School's Teaching Staff: Methodology for Building a Management Model

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Abstract

The article addresses the issue of managing professional motivation among teaching staff in general educational institutions. In the Russian education system, this issue has long been recognized and addressed; however, its contemporary relevance is intensified by the necessity of comprehensively solving two groups of tasks: further improving the quality of general education and ensuring the stability of the teaching workforce. The subject of the study is the theoretical and methodological justification of a model for managing the professional motivation and job satisfaction of teaching staff. The foundational principles for constructing the model are the systemic, process-based, socio-axiological, professionally-environmental, competency-based, scenario-based, and person-centered psychological approaches. The paper demonstrates that the management model implies the alignment of procedures and tools for managing professional motivation with organizational processes aimed at enhancing the effectiveness of professional activity and ensuring professional motivation. To this end, special management mechanisms are proposed. These mechanisms are oriented toward identifying existing and current motivational orientations of teaching staff; revising the determining space of professional motivation that influences the value-meaning structure of teachers' professional readiness; and forming a scenario repertoire for organizing professional motivation within the context of tasks aimed at enhancing the effectiveness of collective, group, and individual activities.

Keywords: model of managing professional motivation, model justification, processes of managing professional motivation, management mechanisms, requirements to model implementation.

1. Introduction

Currently, the general education sector is facing a situation in which, against the backdrop of an increasing threat of staff shortages, the dependence of education quality on teachers'

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professional motivation is becoming increasingly evident. Undoubtedly, motivational support for teaching staff has always been a significant resource for enhancing the effectiveness of professional activity. However, today it acquires special importance not only due to rising demands for education quality but also due to the necessity of ensuring workforce stability in general education. This seemingly obvious and trivial dependency raises a number of acute and controversial issues that require special consideration. Among the primary issues is the problem of theoretical and methodological justification of a model for managing professional motivation and job satisfaction of teaching staff in their professional activities (hereinafter referred to as the management model) – as a set of goal-functional, content-related, and methodological guidelines necessary for organizing relevant work with the teaching staff.

Let us focus on the established practices of managing teachers' professional motivation. Previous research has shown that the mechanisms of the motivation management system do not always correspond to the realities of school practice (Kurbatov, 2016; Kuchina, 2015); regulatory frameworks for effective teacher motivation and its objective assessment are still in the process of formation (Yakovlev, 2016; Krasnoshlykova, Prikhod'ko, 2016); and in many schools, the necessary strategies and tools have not yet been defined (Bakulin, 2015; Volga, 2014, etc.). Under these conditions, many leaders of educational institutions face difficulties requiring thorough analysis of the conditions, processes, and mechanisms of teacher motivation. As a result, teachers often find it difficult to understand on the basis of which indicators and how exactly certain incentive measures are formed. Unsurprisingly, within the teaching community, questions regarding normative stimulation, expansion of its evaluation criteria, development of objective control tools, and more flexible management instruments are increasingly raised and discussed.

This indicates that professional motivation and teachers' satisfaction with their professional activities have not yet become clearly defined objects of management and development.

2. Methodology

The methodology of the study is aimed at justifying a model for managing professional motivation. The essence of the matter lies primarily in identifying the main processes of managing professional motivation and the adequate mechanisms for them within the context of tasks related to collective, group, and individual activities of teaching staff. The problem is addressed through the integration of theoretical and methodological approaches (systemic, process-based, competency-based, etc.) combined with the principles of conceptual modeling and methods of value-meaning specification and decomposition of complex systems.

3. Discussion

In general terms, the essence of employee motivation (whether pedagogical or otherwise) can be reduced to a structural dependency of the state of professional readiness on the stimulation of professional activity:

$$MoW = Rpro - PApro,$$

where

MoW – employee motivation, $Rpro$ – employee's professional readiness, $PApro$ – stimulation of professional activity.

Stimulation is commonly understood as a process of external influence on an individual, group, or collective aimed at increasing their work activity to achieve organizational goals (Sistema..., 2016, etc.). The structural dependency ($Rpro - PApro$) is fundamental for constructing a management model, as it allows simplifying the task of managing professional motivation to such an extent that the model retains key management elements while permitting qualitative analysis and clear interpretation of the results of planning, organizing, regulating, and monitoring professional motivation. Thus, the question arises regarding the necessity of generalizing this structural dependency within the management model, taking into account the main management processes and mechanisms. For the model-building to serve as a reliable foundation for managing professional motivation, it must be theoretically and methodologically substantiated. Only under such conditions can we expect that the practice of managing teachers' professional motivation will meet the requirements of completeness, rationality, and consistency.

Certain steps in this direction have already been taken. Several studies have thoroughly analyzed specific aspects of managing professional motivation: the dependence of motivation dynamics in professional activity on teachers' work experience (Gorbushina, 2019); pedagogical

support for managerial activities of educational leaders in motivating teachers' work behavior (Bakuradze, 2015); creating conditions for enhancing teachers' professional motivation through innovative activities (Korovina, 1999; Volchok, 2006) and through professional development (Arutyunyan, 2012), among others. Nevertheless, these and similar studies do not actually address the issue of modeling management in the essential holistic manner, leaving aside the solution of the following tasks:

– determining the theoretical and methodological approaches to model construction;

– identifying the structure and content of the process of managing teachers' professional motivation as the foundational basis for model development;

– establishing key requirements for the functioning of the model as a framework for the successful organization of professional motivation.

Obviously, the development of a management model urgently requires the application of the systemic approach as a theoretical and methodological foundation. The systemic approach allows representing the management of professional motivation as a set of elementary components (elements) through the interaction of three subsystems: management subsystem (management functions, management procedures, tools for stimulating professional activity); controlled subsystem (motives of teaching staff's professional activity, conditions of professional activity); informational subsystem (normative requirements for the controlling subsystem, normative requirements for the controlled subsystem, direct and feedback loops, stimulation regulations, reporting information).

The interaction of these subsystems enables the construction of a system hierarchy with vertical connections, while interactions within each subsystem establish horizontal connections among its structure and functions. Examples of such systems can be found in numerous works on systems analysis (Peregudov, Tarasenko, 1989; Gorlushkina, 2016, etc.).

However, such a description predominantly employs a methodology of schematization (principles and algorithms of decomposition, techniques of reduction) whereby the entire management system is reproduced as a basic principle of subsystem interaction. Schematization represents the system within a strictly defined logic, highlighting its most significant characteristics according to that principle. The emphasis on isolating subsystems and their elementary fragments (components), with a focus on rigid subordination of parts to the whole, leads to the system losing its flexibility and its ability to adapt to motivational tasks under changing conditions.

Clearly, modeling such a complex and multifaceted system requires the involvement of various theoretical and methodological approaches, each of which specifically influences the development of strategy, tasks, and processes for managing teachers' professional motivation.

What approaches are being referred to in this context?

Transitioning to a comprehensive model necessarily involves defining the characteristics of the object being modeled and, consequently, of the model itself. Managing professional motivation is not a one-time act or isolated action. It is a process extended in time, implying a structural differentiation of relationships and activities among the involved individuals into distinct aspects, key elements, and their interconnections.

The management model describes professional motivation management in invariant characteristics, based on conditions for enhancing the effectiveness of teaching staff's professional activity. The developed model is primarily oriented toward demonstrating the main processes of organizing professional motivation and the actions carried out within each process. At the same time, it is essential to consider the interaction of social and professional-pedagogical values, indicators of education quality, characteristics and indicators of pedagogical competencies, and other factors - all of which permeate the functional subsystems of the model and directly influence teachers' professional motivation and satisfaction with their professional activities.

The content, logic, and overall characteristics of the work required to develop the planned model are described by the methodology of the process-based approach, and the model itself belongs to the class of process models (Grishko, Seraya, 2018; Sharp, McDermott, 2001, etc.). It is precisely this type of model that we are dealing with when discussing procedures, forms, and tools for managing professional motivation.

By a process-based model of managing professional motivation of teaching staff, we mean a systematic representation of the tasks, content, and interrelations of such management processes, along with the mechanisms employed for their practical implementation.

To substantiate such a model, approaches must be applied that reveal the requirements for education quality, the content of pedagogical competencies, value priorities in professional activity, the determining influence of various factors on teachers' job satisfaction, and the specifics of stimulating professional activity. Therefore, in solving modeling tasks, alongside the systemic (Blauberg, 1997; Flood, Jackson, 1991) and process-based (Grishko, Seraya, 2018) approaches, attention should also be paid to the socio-axiological (Kolesov i dr., 2018; Maksimova, 2002; Maslov, Maslova, 2013), professionally-environmental (Shemyatikhina, 2008), competency-based (Kozlova, Golovatenko, 2007; Yalalov, 2008), scenario-based (Bradley, 2001; Hodgson, 2001; Popov, 2001, etc.), and person-centered psychological (Krauskopf, Saunders, 1994; Lyaudis, 1998) approaches, within whose coordinates the model being developed must be appropriately supplemented and clarified.

How should one approach the problem of defining the structure and content of the management model?

From a methodological standpoint, the structure of the management model should not be determined by merely fixing the observed parts and parameters of the system, but rather by identifying and analyzing specific processes while fully preserving the system's integrity. According to this approach, the description of the model's structure stems from management strategy and objectives and includes the following main processes:

– identification of motivational orientations of teaching staff. A motivational orientation is a psychological state that drives a person to choose and perform actions aimed at satisfying their needs, interests, and goals (Mele, 1995). Identifying motivational orientations serves as the starting point for diagnosing teachers' value orientations in professional activity;

– revision of the determining space of professional motivation. Modeling professional motivation within a determining space involves revising the factors influencing the value-meaning structure of a teacher's professional readiness;

– formation of a scenario repertoire for professional motivation. In the management model, the scenario repertoire plays a special role, as it enables the comparison of suitable options for organizing professional motivation and facilitates the practical implementation of one of them.

As for defining the model's content, this issue finds a rational solution through the problem of management mechanisms. The significance of this step becomes clear when we consider that the methodological core of the management model lies in the evaluation and processing of management information. In other words, the focus is on mechanisms that synthesize various aspects of professional motivation and guide, in a specific way, the procedures of developing, making, and implementing management decisions. It is worth noting that in current practice, management mechanisms are often characterized by internal uncertainty, which significantly complicates both the process of professional motivation itself and the means of its organization and regulation.

Management mechanisms should be reviewed from a functional perspective and developed as structural regulators of the main processes of professional motivation. In this context, the specific features of each process must be reflected in the corresponding management mechanisms. Indeed, to understand how a process model should be structured, it is first necessary to identify the structural regulators that determine how and through what means professional motivation should be carried out within a given management process. Since such structural regulators are precisely the management mechanisms, the construction of a process model requires identifying the composition of management mechanisms and detailing their content with respect to all processes of managing professional motivation.

Below is the composition of the mechanisms in a structurally fixed sequence of the main processes of professional motivation management.

1. Identification of motivational attitudes of teaching staff is an *identification mechanism*.

2. Revision of the determining space of professional motivation – *the mechanism of determination.*

3. The formation of a scenario repertoire of professional motivation is a *mechanism of scenario organization*.

The content of the control mechanism, taken as such, is determined by three components: functional orientation (*Ofun*); structural dependence between professional readiness (*Rpro*) and stimulation of professional activity (*PApro*); management tools (*Tman*) that ensure the practical implementation of this structural dependence.

$Mman = Ofun\{<Rpro - PApro>Tman\}$.

During the transition from one management process to another, the management mechanism is transformed in a certain way: the management tasks it is aimed at, the content of variables in the initial structural dependence, and the management tools involved. At the same time, whatever the forms and features of a particular management process, the key components of the mechanism (functional orientation, structural dependence, control tools) are always present in it one way or another – visibly or invisibly, explicitly or implicitly. In short, this is what the most general idea of the content of the professional motivation management model boils down to.

4. Results

Let us now proceed to examining the main processes of managing professional motivation and the mechanisms employed for their practical implementation.

Process: "Identification of Motivational Orientations of Teaching Staff". The functional orientation of this process and its supporting mechanism is the analysis and evaluation of motivational orientations of teaching staff within the framework of the system "education quality - efficiency of professional activity."

Motivational orientations drive action and help maintain persistence in goal attainment (Mele, 1995). Under their influence, current tasks are formed, such as enhancing the effectiveness of professional activity, participating in innovative practices, exchanging professional experience, expanding professional communication, etc. However, motivational orientations are decisive for professional development only if they encourage overcoming emerging barriers. According to their structural affiliation with professional readiness, such barriers should be classified as professional barriers.

Indeed, if one considers a teacher's professional readiness from the standpoint of practical implementation, it becomes evident that various barriers exist - barriers that not only constrain the freedom of professional activity but also define the boundaries of individual behavior and professional growth. It is precisely these barriers that contain information about how and what hinders professional activity, what their specific characteristics are, and which motivational orientations are directly related to them.

The analysis of the impact of different types and forms of professional barriers on the process and outcomes of a teacher's work is presented in numerous studies (Burganova, 1999; Osipova, 2014; Tyunnikov, 1996; Shakurov, 2001, etc.). In particular, it has been shown that the effectiveness of any type of activity is determined by the ability to overcome the barriers that arise within it.

For successful management of professional motivation, it is essential not only to identify and account for professional barriers and their associated motivational orientations but also to consider the dependence of motivational orientations on the process of stimulating professional activity.

Indeed, when addressing the need to specify procedures for managing professional motivation, we are invariably compelled to clarify, on the one hand, the relationship between professional readiness and the characteristic professional barriers inherent to it, and on the other hand, the relationship between motivational orientations aimed at overcoming these barriers and the process of stimulating professional activity of the education professional.

In this case, the management of professional motivation is based on the identification mechanism (*Mid*), in which the initial structural dependency (*Rpro – PApro*) is supplemented by professional barriers (*Bpro*) and associated motivational orientations (*Smot*), while management tools are represented by a set of identification tools (*Tid*). Thus, the identification mechanism takes the following form:

$Mid = Ofun\ \{ < Rpro\ (Bpro: Smot) - PApro > Tid\}$

Process: "**Revision of the Determining Space of Professional Motivation".** A differentiated revision of determining factors according to their significance enables a more substantiated development of the model required for managing professional motivation.

The functional orientation of this process, and accordingly of its accompanying mechanism, lies in identifying factors that exert a significant influence on professional motivation, while filtering out those that are insignificant for its activation and development.

The revision of the determining space involves, first, identifying the set of factors that determine the motivation for teaching staff's professional activity; second, establishing the relationship between barriers to professional readiness and determining factors of professional

motivation; and third, differentiating the determining factors of professional motivation in terms of the influence of stimulation tools on the effectiveness of professional activity.

Let us focus on general issues concerning the revision of the determining space of professional motivation.

As is known, the initiating primary cause of professional activity is motives. At the same time, motives are influenced by various determining factors, which in a specific way affect the employee's attitude toward their work, which in turn is reflected in indicators of its effectiveness.

The socio-axiological, professionally-environmental, and competency-based approaches allow one to examine the characteristics and conditions of motivation management from the perspective of external determinants, while the person-centered psychological approach considers internal (subjective) determinants.

Socio-axiological factors reflect societal values, social values of education, educational priorities, and changes in lifestyle (changes in family composition, attitudes toward professional activity, free time, etc.);

Professionally-environmental factors characterize demographic changes in society, working conditions, the psychological climate within the teaching staff, leadership style, and forms and tools of material and non-material incentives for professional activity;

Competency-based factors include normative requirements for teachers' professional readiness, the composition and level of their professional competencies, and requirements for leadership's readiness to build a comprehensive system of influence on motivation.

In particular, psychological and pedagogical literature provides well-substantiated conclusions regarding the importance of establishing partnership relations within the teaching staff, a democratic leadership style, and balanced material and moral incentives for teachers (Gureev, 2001, etc.).

Often, working conditions in relation to job satisfaction emerge as primary factors in teachers' professional motivation. According to survey data collected between 2019 and 2024 by various institutional structures: 50.6 % of teachers responded that their working conditions and opportunities have deteriorated over the past two years (Indikatory..., 2024); 50 % of teachers believe that low job satisfaction results from unregulated teaching loads (Okolo..., 2021); 52.6 % attribute it to weak social protection of teachers; 48.3 % point to insufficient funding and material support for schools (Mnenie..., 2019); 26.5 % cite the lack of adequate organizational and material-technical support for students' project and research activities (Potentsial..., 2022).

Internal factors that motivate teachers to achieve high results and professional growth include: needs for self-development and self-realization; job satisfaction; a sense of belonging to the team; value orientations; interest in the teaching profession; self-assessment of one's status within the team; readiness for professional motivation; personal qualities (responsibility, emotional stability, communicativeness, persistence, confidence, etc.).

When establishing the relationship between motivational orientations and factors of professional motivation, the following essential point must be considered: factors that determine certain motivational orientations in professional activity become such only if they are imbued with a specific meaning and value. In our case, determining factors acquire concrete significance when the teacher relates them to the professional barriers that hold a distinct personal meaning for them. Therefore, the influence of determining factors on the activation or formation of motivational orientations is not direct or immediate - it is mediated through the perception and interpretation of professional barriers.

For instance, the following dependencies are characteristic for the motivation of a teacher's professional self-development:

– Job satisfaction → Barriers to professional self-realization → Motivational orientation toward professional self-realization;

– Job satisfaction → Barriers to professional communication → Motivational orientation toward developing professional communication;

– Job satisfaction → Barriers to professional self-education → Motivational orientation toward professional self-education.

These dependencies emphasize that job satisfaction motivates a teacher toward professional self-development through the overcoming of specific barriers. For example, a teacher's dissatisfaction with the outcomes of working with students who have insufficient proficiency in the Russian language (*a determining factor*), accompanied by an analysis and interpretation of the

resulting methodological difficulties (*professional teaching barriers*), ultimately activates the intention to change the teaching methodology (*a motivational orientation*).

As a rule, the impact of internal factors on motivation does not occur in isolation but through interaction with other internal and external factors. A particularly illustrative example is the dependence of a teacher's readiness for professional motivation on other factors, including their worldview, receptiveness to stimulation procedures aimed at setting and achieving specific tasks, health status, current life circumstances, and so on.

This fully applies to the psychological state of a teacher's satisfaction with the process and outcomes of their professional activity. Motivation and job satisfaction may share a common positive direction, placing them in a state of structural equilibrium. When their directions are opposite, they are in a state of structural disequilibrium. With respect to professional motivation, job satisfaction functions in two interrelated roles: as an internal factor of professional motivation and as its criterion, goal, and outcome. Regardless of which of these roles is being considered, job satisfaction must be analyzed in the context of not only external factors (e.g., salary, working conditions, sociocultural environment), but also internal factors – one of which may be the employee's readiness for motivation.

As evident, determining factors may exhibit significant interconnectivity, leading to states of equilibrium or structural disequilibrium, and interact with other factors. As a result, initial factors acquire new semantic meanings, and consequently, the content of professional motivation changes. Complex and often ambiguous interrelationships among determinants can hinder the identification of an adequate dependency (*Rpro – PApro*) and the overall construction of a management model – even when all significant factors appear to have been identified.

For managing professional motivation, it is crucial not only to identify the key components of professional motivation (orientations, barriers, factors) but also to rank their interrelationships in a specific context, thereby establishing a clear transition from the identification of motivational orientations to the process of stimulating professional activity. Therefore, the management model must incorporate a special determination mechanism (*Mdet*), which supplements the procedures of identifying motivational orientations with procedures for filtering external and internal factors ($F^{ex}det$,$F^{in}det$) using specialized tools for their revision (*Taud*). As a result, the determination mechanism takes the following form:

$Mdet = Ofun\{<Rpro(Bpro:Smot:F^{ex}det,F^{in}det) – PApro>Taud\}$.

Process: ***"Formation of a Scenario Repertoire for Professional Motivation".*** The functional orientation of this process and its supporting mechanism is the creation of organizational prerequisites for managing the process of professional motivation among teaching staff.

Often, the management of professional motivation is interpreted primarily in terms of material and moral support for teachers, oriented toward general indicators of educational quality. In practice, professional motivation is frequently guided by a single assumption: substantial (primarily financial) stimulation can increase the motivational potential for teachers' professional self-development.

This approach has a significant drawback. The issue is not only that this assumption is only partially valid. Indeed, many researchers have pointed to the absence of a linear relationship between the effectiveness of professional activity and the level of its stimulation (Leont'ev, 2019; Il'in, 2008; Kozubovskii, 2006, etc.). The problem also lies in the fact that this approach often fails to clarify the directions and methods through which a teacher's professional development should proceed, or which specific personal qualities should be prioritized for enhancing professional activity. In effect, this approach completely ignores the organization of the process of increasing professional effectiveness, which risks undermining the centralizing and regulatory role of management in professional motivation.

When managing professional motivation, it is essential to first clearly define the organizational and procedural specifics of stimulating professional activity. This is possible only through the precise alignment of two specially organized processes: *the process of enhancing the effectiveness of teaching staff's professional activity*, and *the process of managing their professional motivation*. In this context, the development of a specialized scenario repertoire becomes highly relevant. The purpose and outcome of this repertoire is to maintain the integrity of the management process by incorporating reserve resources of professional self-development.

Accordingly, the scenario organization mechanism (*Msce*) is supplemented with important structural elements: the scenario design *(Dsce)* and specialized tools for scenario-based organization of professional motivation (*Tsce*):

$Msce = Ofun(Dsce)\{<Rpro(Bpro:Smot:F^{ex}det,F^{in}det) – PApro>Tsce\}.$

The scenario design answers the question of how to link the stimulation of a teacher's professional activity with the formation of relevant motivational orientations toward enhancing the effectiveness of their work. Thus, the scenario design provides a project-based description of professional motivation organization and establishes the conditions for its development.

The tools for organizing professional motivation are developed based on the competency-based approach and take into account the competencies, their structures, and components that meet modern requirements for teachers' professional readiness.

Let us now examine the features of scenario-based organization of professional motivation in the following key areas:

– *Motivation of team-based management of the stimulation process;*

– *Motivation of collective activities of teaching staff;*

– *Motivation of group activities of teaching staff;*

– *Motivation of professional self-development among teaching staff.*

First, it must be emphasized that teachers' participation in managerial activities also requires appropriate motivation.

The formation of a management team and the distribution of functional responsibilities among its members presuppose the application of scenario-based methodology, as it clarifies the requirements for organizing professional motivation, the tasks assigned to team members, the distribution of functions, and the organization of interaction among teaching staff during the motivation process.

It is understood that not all procedures for managing professional motivation are carried out independently by the management team. Some are implemented with the involvement of teachers who are not part of the management team, for instance, self-assessment of motivational orientations, evaluation of teaching conditions, and filtering of factors influencing professional motivation. Management team members may participate indirectly, for example, by providing consultative support or creating the necessary environment.

The mechanism of scenario-based organization of motivation for management team members includes:

– Functional orientation of managerial activities toward the tasks of planning, organizing, and adjusting the professional motivation of teaching staff. Based on the content of the scenario organization mechanism, specific responsibility areas are assigned to team members: "Identification of teachers' motivational orientations," "Revision of the determining space of professional motivation," and "Formation of a scenario repertoire for professional motivation";

– Establishment of a structural dependency between barriers in managerial activities and the motivational orientations of team members within each responsibility area. Accordingly, the scenario design of professional motivation involves evaluating and stimulating changes in this structural dependency. This dependency indicates, on the one hand, the degree of teachers' readiness to prepare and make managerial decisions, and on the other, the feasibility of applying a particular type of scenario for managing professional motivation. For example, team-based management of professional motivation may be implemented under scenarios where decisions are made by school leaders, by the management team, or by the entire teaching staff;

– Development of tools for scenario-based organization of motivation for management team members, including control instruments for assessing the effectiveness of professional motivation, and tools for material and non-material stimulation.

The growing importance of innovative development in general education highlights the need to motivate collective activities of teaching staff. Participation in collective activities implies the formation of motivational orientations among teachers that are oriented toward the future development of the educational institution and the priority directions for the teaching staff's advancement. In this case, tasks of managing professional motivation are addressed through the scenario-based organization of collective activities and the development of appropriate organizational tools.

Accordingly, for the creation and implementation of a scenario for motivating collective activities, the scenario organization mechanism is employed, which includes:

– Functional orientation of the motivation process toward the strategic development of the school;

– Establishment of a structural dependency between barriers and motivational orientations of teaching staff as the main regulator of motivation in collective activities. The scenario design involves creating an environment of competitive interaction among teachers involved in establishing and developing innovative educational practices. Indeed, it is precisely competitive interaction -supported by clear regulations and adequate stimulation tools – that motivates teachers toward active innovation, individual and collective achievements, and coordinated group actions;

– Development of tools for scenario-based organization of professional motivation, defining unified management principles, nomination criteria for process and outcome indicators of collective activity, evaluation criteria for collective work, and stimulation instruments for collective activity.

The results of teachers' competitive participation in the school's innovative development are recorded as outcomes of barrier-overcoming work. When working with barriers, teachers' motivational orientations and reflective, creative abilities are concretely reflected in a set of evaluative nominations. Nominations for assessing the effectiveness of innovative activities include: "Original methodological solution"; "Synthesis of local innovations"; "Methods and techniques for creating comfortable working conditions"; "New solution for interdisciplinary or transdisciplinary integration"; "Expansion of the didactic techniques repertoire"; "Application of new educational technologies"; "Use of summarization methods that broaden the scope of subject study"; "Creation of additional information channels in teaching"; "Enrichment of the bank of creative assignments," etc.

The motivation of group activities is aimed at forming teachers' motivational orientations toward group-based innovative work, including subject-specific pedagogical design, socio-cultural interaction with the micro-community, organizing student volunteer movements, and conducting patriotic, aesthetic, ecological, and economic education events.

The scenario-based organization mechanism characteristic of motivating group activities includes:

– Functional orientation of scenario-based professional motivation toward enhancing the effectiveness of teaching staff's group activities. This functional orientation is achieved by forming a set of roles that predetermine the interpretation of specific problem situations and assign each participant in the group activity a distinct role. Thus, the primary focus shifts to developing those competencies directly related to teachers' professional communication;

– Structural dependency between barriers in group activities and teachers' motivational orientations as the main regulator of professional motivation. The scenario design provides for creating an environment of role-based interaction among teaching staff involved in developing a group project. To this end, barriers to group activities and motivational orientations are co-related with problem situations, the resolution of which requires teachers to assume various roles (e.g., initiator, organizer, methodologist, critic, coordinator, etc.);

– Tools for scenario-based organization of professional motivation in group activities, including unified management principles, nomination criteria for process and outcome indicators of group activities, evaluation criteria for teachers' group work, and instruments for stimulating professional self-development.

The essence of professional self-development motivation is expressed in the teacher's need for creative self-realization and professional self-assertion.

The motivation for professional self-development among teaching staff is regulated by the scenario organization mechanism, with the following characteristic components:

– Functional orientation of the professional motivation scenario toward the teacher's professional self-development. For functional focus, it is essential to consider those competencies of teaching staff whose implementation is hindered by the presence of professional barriers and insufficient motivation for professional self-development;

– Structural dependency between barriers to professional self-development and teachers' motivational orientations. In this case, the scenario design views professional self-development through the lens of a dual opposition. At one pole lies the initial state of the teacher's professional readiness, complete with inherent barriers (e.g., resistance to structural changes in education or pedagogical innovations). At the other pole are the teacher's current motivational orientations of

the teaching professionals, embodying a system of professional values and a need for professional self-development;

– Tools for scenario-based organization of professional motivation, establishing unified management principles, nomination criteria for key aspects of professional self-development, evaluation and self-evaluation criteria for professional self-development, and instruments for stimulating professional self-development.

In the practice of organizing professional motivation, it is essential to consider indicators of the effectiveness of a teacher's participation in collective and group innovation activities, as well as indicators of their professional self-development. Therefore, the evaluation of professional activity effectiveness should be based not only on its final outcomes but also on the indicators of the process leading toward those outcomes.

What requirements for the management model arise from its justification?

Firstly, it is crucial to identify the actual resources available to the general educational institution for both material (monetary compensation, non-monetary rewards) and intangible (public recognition, authority within the teaching staff, acknowledgment of specific achievements, opportunities for professional self-realization) stimulation.

Secondly, special attention should be paid to the normative-legal regulation of professional motivation. A well-developed Regulation on professional motivation of teaching staff can prevent skepticism and potential conflicts from arising at the initial stage of implementing a new stimulation system.

Thirdly, the mechanisms of managing professional motivation constitute a necessary and rational form of regulation. Scenario-based organization of professional motivation is based on three key mechanisms: Identification of teaching staff's motivational orientations; Determination of professional motivation; Scenario-based organization of professional motivation.

Fourthly, achieving the goals of professional motivation depends on the presence and degree of development of management principles. These principles must perform specific functions: Coordinate the system of managerial actions; Respond to social demands; Regulate the management of professional motivation, including the processes of identifying teachers' motivational orientations; Revise the existing determining space of professional motivation; Form a scenario repertoire for professional motivation in the formats of professional self-development and collective and group innovation activities.

5. Conclusion

The discussion of the mechanisms underpinning the management model was conducted with leaders of institutions of general education during professional development courses. To ensure a consistent analytical framework, an expert assessment matrix and a SWOT analysis algorithm were applied. The obtained results suggest that the proposed mechanisms are acquiring primary significance in contemporary practices of managing professional motivation, as they contribute to the formation of effective regulatory tools for enhancing the professional effectiveness and self-development of teaching staff.

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Interaction between Teachers and Students in the Process of Educational Activities in the Higher Education System

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Abstract

Interaction between teachers and students during the implementation of educational activities in an educational organization of higher education is analyzed in the article. The authors identified the main models of interaction between teachers and students as subject-subject, subject-object and object-subject and conclude that a person (subject), interacting with an object, can define it as a subject if he evaluates it as active, holistic and independent. The authors are of the opinion that teacher-student interaction belongs to the type of subject-subject interaction. The author's questionnaire designed on the basis of theoretical analysis and a series of interviews with students and teachers was used. The questionnaire included 19 statements describing such qualities of teachers as prestige and general competence, emotional competence, social skills, expertise in communication, characteristics of role behavior, and interest towards students. The questionnaire also included statements about students' readiness to follow the role models of teachers in professional behavior. The study involved 2nd and 3rd year students with the major "Social Sciences" at various universities in Moscow (the total sample size was 90 people; 21 male, mean age – 20.1 years). Processing of empirical data include Descriptive Statistics and Exploratory Factor Analysis which were carried out using the statistical package SPSS 24.0. Results show that students rate the professional competence of teachers as high, social status of teachers, their emotional competence, including in interactions with students and role models of professional behavior as above average. At the same time, students associate the formation of their behavioral repertoire with their own experience and do not rate the general social competence of teachers as high. The practical significance of the results lies in identifying problem areas in high education.

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Thus, to increase to increase the perceived overall social competence of the teacher, it is necessary to organize classes in such a way that students have the opportunity to see the teacher in real social situations, but not only in classrooms.

Keywords: education, development, higher education, students, teachers, social interaction.

1. Introduction

It is obvious that the quality of interaction between the parties is of great importance for all participants involved in the educational process. We would like to particularly emphasize the word “interaction” or even “social interaction” (From the editorial..., 2008), and not “provision of educational services”, because in the latter case there is an ambivalent feeling that the teacher is providing some kind of service to the student. In the Russian mentality, the phrase "to provide a service" carries a negative connotation, which consequently affects both the image of individual teachers and the prestige of the profession as a whole. The problem of the declining prestige of the teaching profession has attracted not only public attention, but is also reflected in the relevant amendments to the Federal Law (14.07.2022 No. 295-FL): “provision of state (municipal) services in the field of education” was replaced by the wording “financial support for the implementation of educational programs” and “financial support for the implementation of state or municipal tasks” (Federal Law..., 2022).

The interaction of a person with significant social objects can be subject-subject, subject-object and object-subject (Grachev, 2020). A person (subject), interacting with an object, can define it as a subject if he evaluates it as active, holistic and independent [ibid]. In the context of interaction between teachers and students in the process of educational activities in the higher education system, this classification can be presented as follows: 1) subject-object interaction (teacher is a subject, student is an object), the teacher is an active initiator of interaction, independently determining what knowledge, values, and skills should be developed in the student, while the latter remains only in the passive role; 2) subject-subject (both the student and the teacher are considered as subjects) such interaction presupposes the mutual influence of both partners, the relationship is characterized by recognition of the value of each other's activity, significance and value; 3) object-subject interaction (teacher is object, student is subject), the teacher acts as a passive transmitter of knowledge and skills, the student, on the contrary, is active, holistic and self-determined participant in interaction. Further, we, of course, adhere to the second approach, understanding both the student and the teacher as active subjects of interaction, possessing a system of representations about the role of themselves and partners in the interaction process but concentrating on student's part of interaction.

The interaction between teacher and student, both as a pedagogical and as a socio-psychological phenomenon, can be considered from different theoretical and methodological positions. We consider it promising to turn to the systems approach (Lomov, 1984, Shikhirev, 1999), symbolic interaction theory (Andreeva i dr., 2001; Makateng, 2024) and social exchange theory (Blau, 1964; Cropanzano, Mitchell, 2005; Mauss, 1925). That is, in our opinion, social interaction takes place between the teacher and the student during the learning process, taking into account certain social roles and involving social exchange.

In order to analyze the socio-psychological patterns of interaction between a student and participants in the educational process, it is necessary to briefly turn to the systems approach that describes the social environment. This aspect is important in the context of our work, since a university, as a social institution, should be considered as a social system in the context of which the professional formation of students takes place. R. Ackoff, F. Emery (Ackoff, Emery, 1974) define a system as an integral complex of interconnected elements, each of which is connected with other elements directly or indirectly; the elements create subsets that are also interconnected with each other.

M. Bunge's systems approach describes society as a system of interconnected individuals, while society itself is considered as having systemic properties. At the same time, it is postulated that some of these properties are reducible to individuals, since they are the result of their actions, and some are “determined by the functioning of the system itself” (Shikhirev, 1999). Individuals feel the influence of society through social groups, which assign social roles to the individual that determine his behavior. This methodological aspect is crucial for our work, since it determines the systemic parameters of interactions within the university as a social system. The main provisions of Bunge's system approach are summarized by P.N. Shikhirev as follows: “1) society should be

considered by studying the socially significant characteristics of the individual, as well as the properties and changes of society as a whole; 2) social facts should be explained in terms of individual and group behavior, as well as the interaction of individuals and groups; individual behavior should be explained by the biological, psychological and social characteristics of the person as a member of society; 3) hypotheses about the patterns of functioning and development of society must be substantiated by sociological and historical data containing information about individuals and small groups, because only the latter are available for empirical observation" (Shikhirev, 1999).

As properties of the social system B.F. Lomov highlights its structure, hierarchy, relationships between elements, changes and their patterns, including patterns of development, as well as external relationships (Lomov, 1984). Thus, it is important to emphasize the need for holistic integration of the student into the social system, which includes not only the educational environment, but the social environment in a broad sense – society, public institutions, social groups with which the student interacts. Studying the problem of interaction between a student and participants in the educational influence on him requires studying the concept of "interaction" as a category of psychological science, analyzing the place and role of the subjects of interaction in the educational process. Let's turn to symbolic interaction and role theory.

Symbolic interactionism. According to J. Mead, J. Habermas and H. Blumer, who relied on the views of Georg Simmel, society is built on the exchange of gestures and symbols as elements of communicative interaction, which, in turn, is presented as the essence of society (Andreeva i dr., 2001). The tools of interaction within the framework of the approach under consideration are language, as well as the exchange of symbols and gestures, however, analysis and understanding of their meanings is not enough to understand human behavior as social. The key to such understanding is the knowledge of a kind of code – the internal symbolic meaning of linguistic symbols used by participants in social interaction and understandable to all participants in social interaction. What is important is that these symbols have a predictive function, thanks to them people can understand the expectations of other people and predict the consequences of their actions and behavior.

An important scientific contribution of symbolic interactionism was also the development of the concept of the reflective individual, according to which the reflective individual is a creative and thinking agent, comprehends and rethinks the meaning of his behavior and conducts a constant internal dialogue. The self, starting with Mead, is divided and appears in two forms: "I" and "me." "I" is an acting and thinking subject, creator, initiator. "Me" is a subject reflecting on his "I", reflecting on "himself" and "others" in various contexts - places, situations, time, both real and imaginary. Essentially, it can be described as a mirror through which a person looks at himself and, accordingly, sees himself through the eyes of others. This is the way in which society influences the subject through a kind of passive part of his "I" (Andreeva i dr., 2001).

One of the significant focuses of research interest is the reflective subject, capable of internal dialogue with himself. In our opinion, understanding the interaction of participants in education in the development of youth based on the interactionist concept opens up wide practical opportunities, since it is how a young person sees himself through the eyes of others, how he comprehends himself and his actions, that determines his actions.

Thus, this approach opens up wide opportunities for helping participants in the educational process to young people in forming a repertoire of social roles, which, in turn, shape the personality of a professional and a mature member of society. It is also necessary to take a closer look at the "roles" category. Roles are described by scientists through the category of "role expectation" prescribed to a person by society and social relations. Actually, role acceptance is carried out through the understanding of expectation, enshrined in the conventional norm. Roles are understood as a kind of behavior patterns that impose rights and responsibilities on a person. Fulfilling a role is understood as fulfilling the duties imposed by the role. In the context of the educational process, in order to analyze the interaction between a student and a teacher as a mutual exchange of various kinds of resources, a balance of inputs and outputs, obligations and expectations (Blau, 1964; Cropanzano, Mitchell, 2005; Homans, 1958; Mauss, 1925), other theories can be used, for example, the theory of social exchange and the theory of psychological contracts (Ampofo-Ansah i dr., 2019; Blau, 1964; Bordia i dr., 2018; Cao i dr., 2007; From the editorial..., 2008; Koskina, 2004; Liao, 2013; Petersitzke, 2009). Social exchange theory (SET) has had a significant impact on the development of various scientific fields, disciplines and areas of scientific

knowledge (Ahmad i dr., 2023), including social psychology (Homans, 1958), sociology (Blau, 1964) and anthropology (Mauss, 1925). R. Cropanzano and M.S. Mitchell point out that SET is "very flexible and can describe almost any outcome of economic and social exchanges and transactions" (Cropanzano, Mitchell, 2005). Researchers of psychological contracts usually refer to social exchange theory as the theoretical basis of the psychological contract (Koskina, 2004, Petersitzke, 2009). The student psychological contract is "individual or group subjective understandings of the reciprocal exchanges between students, their teachers and their learning institution. It is made up of promissory (transactional) and non-promissory (relational and ideological) expectations that are not written in any formal agreement; yet, they may operate powerfully as determinants of attitude and behaviour, and potentially attrition and performance" (Koskina, 2004).

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Thus, we consider the student as a reflective subject who is in the process of filling his professional role with content and has certain expectations from the teacher. The repertoire of a student's social role is determined by the system of his interactions in the context of person-society and person-social institution. The research emphasis on the importance of forming a repertoire of professional social roles among students determines the concept of the empirical part of the study, focused on studying students' representations about teachers as a social professional group with which students directly interact. The construction, in the process of social interaction, of representations about teachers as representatives of a professional group (social objects), forms, among other things, the role-playing professional repertoire of students. In the empirical part, students' representations are examined, including their the cognitive, emotional-evaluative and pre-behavioral components.

2. Materials and methods

To achieve the stated objective of the study, a questionnaire was developed based on existing research in this area (Ampofo-Ansah i dr., 2019; Arnup i dr., 2024; Bordia i dr., 2018; Bordia i dr., 2010; Itzkovich, 2021; Tomlinson i dr., 2023), as well as interviews conducted by the authors with students and teachers at the pilot stage of the project. Of the total number of 19 statements that required a degree of agreement from 1 to 5, the majority in their content touched upon the competence of individual teachers (emotional and general social), their skills (communicative, social), as well as the characteristics of role behavior and more general issues of the prestige of the profession as a whole. The questionnaire also included statements about students' readiness to follow the role models of teachers in professional behavior. Psychometric testing confirmed a high level of consistency among questionnaire items (Cronbach's alpha above 0.8). Additionally, questions were asked to identify socio-demographic characteristics, employment, and subjective assessment of academic performance.

Sample. The study involved 2nd and 3rd year students studying the major "Social Sciences" at various universities in Moscow (the total sample size was 90 people):

– 21 male, 69 female;
– Average age – 20.1 years;
– Minimum age – 18 years, maximum – 25 years;
– Married – 5.1 %, unmarried – 94.9 %.

Unlike first-year students, second- and third-year students have already developed an understanding of what to expect from a university teacher (unlike a school teacher) and can answer the questionnaire more consciously (Gagarina, 2008). Fourth-year students were not included in the survey because they were on an internship.

Processing of empirical data was carried out using the statistical package SPSS 24.0. Descriptive statistics and Exploratory Factor Analysis were employed.

3. Results

Analysis of descriptive statistics (Table 1) shows that students rate the professional competence of teachers most highly (5, 13). The social status of teachers (4, 6, 14) and role models of professional behavior (18) are also rated above average.

It is also important to note the positive assessment by students of the emotional competence of teachers, including in interactions with students (3, 11). Students also associate the formation of the cognitive component of their future professional image of the world with interaction with teachers as significant elders (2, 16, 19). At the same time, students associate the formation of their behavioral repertoire with their own experience (15, 17). Students do not rate the general social competence of teachers as high (1).

Table 1. Descriptive statistics

	M*	Med	SD	Min	Max
1. I believe that my teachers are socially competent people.	1,1899	1,0000	,53292	1,00	3,00
2. I perceive interactions with teachers as meaningful to me.	4,0127	4,0000	,96733	1,00	5,00
3. I believe that my teachers have emotional competence, which makes interactions with them appropriate and valuable.	3,9114	4,0000	,94990	1,00	5,00
4. I can rate the social skills of my teachers as follows (from low to high)	4,2658	4,0000	,71088	2,00	5,00
5. When I communicate with teachers, I feel that I am talking with knowledgeable and competent people	4,4051	5,0000	,85514	2,00	5,00
6. My teachers have achieved a lot in their lives, there is a lot to learn from them.	4,0380	4,0000	,86888	2,00	5,00
7. I don't think that studying at a university will sufficiently prepare me for real professional life.	2,9620	3,0000	1,13728	1,00	5,00
8. When I am faced with a difficult social situation, I would like to turn to the teacher for advice.	2,8228	3,0000	1,25840	1,00	5,00
9. I believe that my teachers would be able to successfully handle communication situations in which I have difficulty	3,5190	3,0000	,99821	1,00	5,00
10. In my opinion, a teacher will always be able to find the correct way out of a difficult communicative situation	3,5190	3,0000	,95891	1,00	5,00
11. When interacting with teachers, I feel that they are interested in supporting me.	3,5823	4,0000	1,02040	1,00	5,00
12. I believe that teachers really strive to include topics in academic disciplines that will be useful to me in the future	1,6076	1,0000	,85362	1,00	3,00
13. I trust the opinions of teachers on issues related to my future professional activities	3,7722	4,0000	1,06156	1,00	5,00
14. I believe that my teachers are accomplished and respected people	4,2025	4,0000	,77426	2,00	5,00

	M*	Med	SD	Min	Max
15. I believe that I will learn the correct ways of behavior in my work myself when I go to work and gain professional experience	4,2405	4,0000	,78797	2,00	5,00
16. I believe that in my work I will remember the advice that my teachers gave me	3,8481	4,0000	,96195	1,00	5,00
17. When I encounter difficult professional situations, I imagine how my teachers would behave in this case.	2,3924	2,0000	1,15933	1,00	5,00
18. I believe that my teachers give me correct examples of professional behavior.	3,8734	4,0000	,96565	2,00	5,00
19. I expect that by the end of my studies at the university I will have an understanding of how to act in significant professional situations	3,8861	4,0000	,99984	2,00	5,00

Notes: * M – mean value, SD – Standard deviation, Med – median value

Exploratory factor analysis (EFA) performed by the principal components method (PCA) (Watkins, 2018) showed that the questionnaire statements were grouped into 5 factors (components). The results are presented in Table 2.

Table 2. Results of Exploratory factor analysis (EFA), rotated factor matrix[a]

Statements	Components				
	1	2	3	4	5
1. I believe that my teachers are socially competent people.	**-.709**	-.138	-.030	-.039	-.073
2. I perceive interactions with teachers as meaningful to me.	**.644**	-.068	.205	.401	.193
3. I believe that my teachers have emotional competence. which makes interactions with them appropriate and valuable.	**.603**	.460	.311	.013	.209
4. I can rate the social skills of my teachers as follows (from low to high)	**.655**	.488	.068	.054	.152
5. When I communicate with teachers. I feel that I am talking with knowledgeable and competent people	**.672**	.348	.110	-.130	.438
6. My teachers have achieved a lot in their lives. there is a lot to learn from them.	.394	.441	.489	.144	.227
7. I don't think that studying at a university will sufficiently prepare me for real professional life.	-.268	-.100	**-.664**	-.216	.036
8. When I am faced with a difficult social situation. I would like to turn to the teacher for advice.	.129	.245	.008	**.831**	.058

Statements	Components				
	1	2	3	4	5
9. I believe that my teachers would be able to successfully handle communication situations in which I have difficulty	-.022	**.828**	.097	.133	.198
10. In my opinion. a teacher will always be able to find the correct way out of a difficult communicative situation	.327	**.727**	.109	.273	.052
11. When interacting with teachers. I feel that they are interested in supporting me.	.370	.502	.110	.424	-.134
12. I believe that teachers really strive to include topics in academic disciplines that will be useful to me in the future	-.189	-.067	**-.762**	.030	-.307
13. I trust the opinions of teachers on issues related to my future professional activities	**.691**	.053	.201	.328	-.058
14. I believe that my teachers are accomplished and respected people	.540	.430	.384	.115	.109
15. I believe that I will learn the correct ways of behavior in my work myself when I go to work and gain professional experience	.434	-.207	-.588	-.080	.293
16. I believe that in my work I will remember the advice that my teachers gave me	.343	-.010	.437	.490	.379
17. When I encounter difficult professional situations. I imagine how my teachers would behave in this case.	-.036	.269	.232	**.649**	.410
18. I believe that my teachers give me correct examples of professional behavior.	.373	.373	.135	.187	.466
19. I expect that by the end of my studies at the university I will have an understanding of how to act in significant professional situations	.103	.114	.049	.157	**.789**

Extraction Method: Principal Component Method. Rotation method: Varimax with Kaiser normalization.

a. Rotation converged in 16 iterations.

We accept 5-factor structure because all factors appeared theoretically meaningful; for interpretation we choose only statements with loading over 0.6.

The first factor «the competence of teachers» includes 6 statements describing professional, social and emotional competence and the significance of interactions with teachers for students (Table 2) and these parameters are high (Table 1).

The second factor «the communication skills of teachers» includes 2 statements (Table 2) which do not have high scores in student assessments (Table 1);

The third factor «representations about the efforts of teachers to work on the content of academic disciplines» includes 2 statements (Table 2) emphasizing the usefulness of the material for preparing for future professional life and do not have high scores in student assessments (Table 1);

The fourth factor «a cognitive-behavioral block that accumulates teachers' perception as a point of reference in making evaluations and decisions» includes 2 statements (Table 2) and the last factor «students' pre-behavioral readiness to follow their model» consist only 1 statement (Table 1).

In Table 3 total variance explained is presented.

Table 3. Total variance explained

Component	Extraction sums of squared loadings			Rotation sums of squared loadings		
	Total	% variance	Cumulative %	Total	% variance	Cumulative %
1	7.460	39.263	39.263	3.912	20.591	20.591
2	1.690	8.896	48.159	2.785	14.656	35.247
3	1.299	6.837	54.996	2.250	11.844	47.091
4	1.237	6.511	61.507	2.062	10.850	57.941
5	1.085	5.712	67.219	1.763	9.278	67.219

4. Discussion

According to results, there is ambivalence in students' perception of teachers: on the one hand, students note high professional, emotional and role competence and on the other hand, general social competence and reference in the behavioral aspect are rated lower. Factor analysis showed that students' perceptions of teachers are grouped into 5 blocks: Competence, Communication skills, Representations about the future, Teacher as a point of reference in making evaluations and decisions, Expectation of professional and behavioral competence. The structure we obtained is partially consistent with the results of other studies. Y. Itzkovich identified for aspects of students' expectations in the context of the psychological contract: (1) fair treatment and high moral standards in evaluation of students performance, (2) quality of teaching and use of various teaching methods, encourage in-depth thinking, and be interesting, (3) knowledge in the scientific field and the currency of learned material, and (4) deviant expectations shifting the responsibility for the learning and achievements from the students to their faculty (Itzkovich, 2021).

In systematic review sought to understand student expectations of teaching and learning when starting university, four groups were identified: additional study, self-managing learning, teaching and learning activities, and accessibility of a teacher (Tomlinson i dr., 2023). International students expect best possible educational, social and psychological experience (Bordia i dr., 2018).

In our study, students have high expectations of teachers' the competence of in professional, social and emotional spheres and rate the interactions with teachers as significant. While the requirements for professional qualifications and a high level of knowledge are confirmed in studies by various authors (Itzkovich, 2021; Tomlinson i dr., 2023), it is also important that students expect emotional involvement from teachers in the teaching process (Gretzky, Lerner, 2021).

Students also have expectations about one's own professional and behavioral competence by the end of university studies. This result suggests that students potentially expect that the university, as a social and professional institution, will prepare them for their future professional life. This circumstance creates a stable basis for improving teaching practices at the university, including strengthening those aspects of interactions between teachers and students that are aimed at developing relevant role models among students. It is especially important for international students that teachers adhere high standards of education connected with the future career, because they sacrifice work and career opportunities in their home countries in order to study in the host country (Bordia i dr., 2018).

But in our study, representations about the efforts of teachers to work on the content of academic disciplines, which emphasize the usefulness of the material for preparing for real professional life have average significance. This may be due to the fact that students have vague ideas about their future professional activities and have not yet made their final decision about employment. The communication skills of teachers also do not have high scores in student assessments. It is necessary to pay attention to the fact that the formation of the behavioral repertoire of a professional role at this stage (completion of the second year of bachelor's degree and third year) in the minds of students occurs regardless of interactions with teachers. Despite the

high social status of teachers in the perception of students, students rate the social competencies of teachers as low. This may be due to a generational gap and to the lack of competence of teachers in the digital environment, including communication. In any case students associate the formation of their own repertoire of professional roles with their own experience. Another possible explanation may be related to the extent to which students themselves are willing to contribute to the development of their own competencies. «Students' realistic aspirations about their educational attainment (expectations) are predictive of their efforts, actions, and future outcomes» (Arnup i dr., 2024). It has been shown that the more effort students put into research projects, the higher their expectations of their supervisors will be (Bordia i dr., 2010, Homans, 1958). However, the intensity of effort put in by students may vary depending on their personality (Bordia i dr., 2010). It is also shown that the expectations of students and teachers are not something fixed and rigid. Students' representations about the responsibilities of teachers can undergo significant changes as they study, gaining knowledge about the functioning of the university, its rules, and the distribution of roles and areas of responsibility among different participants in the educational process. As a result, initially vague and undefined, these representations increasingly begin to reflect the real state of affairs in the interaction between teacher and student (Ackoff, Emery, 1974).

The limitation of the study is the problem of heterogeneity of the sample, the number of female respondents is three times higher than that of male respondents. This limitation can be overcome in future studies.

5. Conclusion

Summarizing the results obtained, we can draw the following conclusions.

Firstly, the relationship between participants in the educational process can be considered from the perspective of a systems approach, symbolic interactionism and social exchange theory. During social interaction, students form representations about the teacher as a representative of a professional social group, possessing expertise, correct role models and emotional competence. This result is of deep significance for the teaching practice of universities, since it indicates that there is no significant gap between the expectations of students and representations about teachers as representatives of a professional group. The identified pattern shows a confident basis formed by the middle of their studies at the university for the further formation of correct professional role models in students due to the emotional and cognitive components of social cognition in the field under study.

Secondly, increasing the effectiveness and efficiency of pedagogical influence is based on the personality and social status of the initiator, as well as the use of special techniques to increase involvement. Deep integration of the teacher into the social environment, recognition by society of his high status, the use of correct role models of behavior that are highly valued by society, as well as demonstration of deep conviction in his words and actions will ensure the effectiveness of interaction in the educational process.

Third, to increase the perceived overall social competence of the teacher, it is necessary to organize classes in such a way that students have the opportunity to see the teacher outside the classroom. A teacher can act in different roles and implement different functions. The interaction between a teacher and a student can be not only learning-oriented, but also personality-oriented and involve going beyond their social responsibilities (roles of teacher and student, as well as the time frame of work and study), willingness to do more, immersion in the problem and showing sincere interest. Universities should encourage not only formal forms of interaction, but also informal ones, for example, attending social events, conducting excursions, or simply studying outside the classroom. If education is set as a task, then this is not only an assessment of academic performance, but also about behavior in a broad social context (in transport, in the yard, in a cinema, in a museum, and just on the street). For example, how teacher/student speaks, greets, interacts, solve problems and disagreements. This can be fully seen (and in some cases, corrected, suggested, set an example) only in "natural conditions".

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Teaching Internship Program (Amity): Contributions to Non-Native EFL Teachers of El Salvador

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Abstract

The advancement of a skilled labor force in El Salvador has been significantly supported by the professional development of English Language Teaching (ELT), particularly among teacher candidates in their senior years of study. This qualitative study explored how non-native English as a Foreign Language (EFL) teachers perceive the internship program experience, AMITY. This qualitative study, cemented in hermeneutic phenomenology, analyzed participants' experiences using Atlas.ti software. Through homogeneous sampling, eight individuals with shared characteristics were selected. Interviews were conducted via Microsoft Teams, using a phenomenological interview protocol. There were two main themes derived from the participants' experiences: their perception of the program and their professional development. As part of a minority group, while living in the United States, they have now a better understanding of the issues that diverse populations go through, making them more empathetic with their students. Professionally, it has helped them to adapt and integrate non-traditional teaching approaches to El Salvador; such as games, stratified classroom areas, and the integration of ICT (Information Communication Technologies) into their sessions as teachers in El Salvador. All these shifts seem to interfere with their students' learning of English as a Foreign Language.

Keywords: EFL, hermeneutic phenomenology, teaching workforce, professional development, exchange programs.

1. Introduction

In recent years, English Language Teaching (ELT) professionalization in El Salvador has experienced significant growth, with teacher candidates in their junior and senior years actively pursuing various international professional development. The Amity Institute, a U.S.-based

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nonprofit, supports these non-native English speakers through internship programs administered locally by the Salvadoran American Scholarship Program (SASP), established in 2013 by the U.S. Embassy.

Despite the program's existence, a critical research gap persists to understand how these non-native EFL teacher candidates perceive their internship experiences and translate acquired knowledge into teaching effectiveness. This study created an updated qualitative database and established a precedent for future comparative studies exploring international bilingual internship programs.

The research addresses multiple scholarly interests. Huang and Varghese (2015) argue that categorizing non-native English-speaking teachers inadequately captures their complex roles. Guo et al. (2021) highlight specific barriers interns encounter, including communication challenges and the need for culturally adapted instructional materials. Aneja (2016) argues that language and identity are continuously shaped and reinforced through everyday interactions and communication. Therefore, it has been suggested that to move beyond the rigid distinctions between native and non-native speakers, a poststructuralist orientation is needed to increase equity in the field of ELT. Importantly, Alghofaili and Elyas (2017) demonstrated that teacher effectiveness stems from competence and experience, not nationality.

By documenting internship experiences, the professionalization of ELT in a non-native speaking context, will overall benefit the involved stakeholders, teacher candidates, faculty members, and higher education institutions interested in understanding the transformative potential of bilingual exchange programs.

The Socio-Cultural Theory

Vygotsky's (1978) sociocultural theory fundamentally claims that cognitive development emerges through social interactions and cultural environments. By emphasizing mediation, scaffolding, and the Zone of Proximal Development (ZPD), this framework illuminates how cultural tools like language facilitate learning (Shabani, 2016).

Within educational contexts, particularly in the AMITY intern program, this theory manifests through professional growth occurring via guided, real-world experiences. Wenger's (2010) situative approach complements this perspective, highlighting communities of practice as critical learning mechanisms. Swain and Lapkin (2013) further extend this understanding by demonstrating how multilingual repertoires serve as cognitive tools in collaborative learning environments.

Mercer et al. (2017) reinforce these insights, suggesting that dialogic interactions, especially when supported by digital technologies, can significantly enhance educational outcomes. The sociocultural extension of Kolb's theory, as interpreted by Beckett and Hager (2002) and Fook (2023), emphasizes that learning transcends internal cognitive reflection, becoming richly contextualized through external social interactions.

For teacher interns, this approach underscores the importance of authentic teaching contexts where reflective practice, mentorship, and collegial support converge to facilitate meaningful professional development.

2. Methods

This qualitative study was grounded in a hermeneutic phenomenological approach to understanding the nuances of lived experiences, both individual and collective. According to Husserl (1998), this approach helps to capture the complexity of individual and group experiences by explaining the nature, essence, and truth of phenomena. The study used homogeneous sampling to select participants based on shared characteristics relevant to the research objectives. Patton (2015) highlighted this approach as focusing on individuals with similar experiences to gain deeper insights into specific issues, prioritizing the richness of their experiences, as noted by González (2021).

Participants were drawn from the 2017–2020 cohorts of an international teaching exchange internship program, holding bachelor's degrees in English and actively teaching in diverse educational settings, including K-12 schools, language academies, and higher education institutions. Recruitment was conducted through professional networks via email, with informed consent obtained. A total of eight participants, two males and six females, with an age range of 23 to 27, from different regions in El Salvador, including Santa Ana, San Vicente, San Salvador, and San Miguel. Data collection involved 65-minute online interviews conducted via Microsoft Teams, with transcription done using Otter.ai.

Data analysis was performed using Atlas.ti facilitating the organization and identification of themes within the data. Initially, open deductive coding allowed themes to emerge; this was

represented in Atlas as codes. Next, axial coding permitted to group the codes into groups or Group code in Atlas. The group code became the final theme discussed here.

3. Results

Theme 1: Career path

The participants' narratives reveal a shared journey of discovering and embracing teaching, shaped by diverse experiences and personal contexts. Mary reflected, "I was not applying for Amity but for a scholarship to study one semester at one of the universities in the United States. [...] Later, they called and offered me an internship, which I decided to take." This highlights how external circumstances, such as the unexpected offer to join the AMITY program, can guide individuals toward paths they might not have initially considered. Such moments underscore the role of serendipity and adaptability in shaping career trajectories and personal growth.

George echoed the formative impact of early informal teaching experiences: "When I was still a student at university, they had clubs where you could work with other students, helping them teach something. [...] Technically, I was teaching since my first year at university, but it wasn't official, just for the clubs." These interactions nurtured a natural affinity for teaching, where peer engagement planted the seeds of his teaching identity. His experiences highlight how external recognition of his abilities and personal enjoyment shaped his journey, illustrating the influence of informal settings in developing professional aspirations.

Mandy's journey into teaching began at just 15, working with kids and youth groups at her church. "I started teaching at church when I was 15," she shared. "Later, while pursuing my associate degree in English, I was asked to teach English to kids as well." Teaching Bible studies in Sunday school and later English classes on Saturdays allowed her to work with children and teenagers, fostering essential communication and instructional skills. These early experiences not only built her confidence but also deepened her passion for education, ultimately inspiring her to pursue teaching as a professional career.

Missy's shared a powerful shift in perception. "Since I was a kid, I had always wanted to be a teacher," she shared. "At first, I didn't like English and thought I'd be a math teacher. [...] I had a teacher who made me fall in love with the language." Her early resistance to English changed through the influence of an inspiring teacher, igniting a passion for the subject. This transformation highlights how a teacher's enthusiasm can shape a student's attitude and career path, ultimately leading Missy to pursue a degree to become an English teacher.

John's journey into teaching took a few unexpected turns but ultimately led him to a fulfilling career. "Since high school, I enjoyed being a teacher assistant and decided to pursue teaching as my major," he explained. Although he initially dreamed of becoming a science teacher, his PAES test score wasn't high enough, so he shifted to English. By 2015, he was assisting with English and business English at a university, and the experience solidified his passion for teaching. Later, he gained formal experience in schools and even taught Spanish during an internship in the U.S. Today, he thrives as an educator at a tech university and academies, showcasing how flexibility and determination can shape a rewarding career.

Connie and Jeff agreed on how formal opportunities (scholarships and teaching positions) further solidified their educator identities. In 2014, Connie received a scholarship to continue her teaching degree:

During my fifth year, I got a scholarship for the AMITY program and worked as a teacher assistant in a Spanish immersion school in Minnesota for about 10 months. I learned about teaching techniques, discipline, and routines used in U.S. immersion schools. After returning to El Salvador, I finished my degree and graduated in December. By January, I started teaching basic English at the university, working with students in international relations, communications, journalism, and English language majors until August 2021.

When Jeff chose his major, he hesitated to become a teacher:

... until I took the Didactics III course at university. I had the opportunity to teach at a school in my hometown [...], where I conducted activities for fifth and fourth-grade students. I realized I was good at it, and the students enjoyed my lessons. In January 2015, (started) to teach in the English extension program, marking the start of my formal teaching career. I worked there for six months before going to the United States, and after returning, I continued at the university while developing my career at various places.

For these two participants, professional development was driven by structured experiences and academic advancement, supported by institutional frameworks. These accounts illustrate how formal and informal teaching experiences converge, shaping the participants' commitment to education.

Sheldon:

I feel satisfaction when I see my students improve and learn throughout the process of acquiring a second language. It can be difficult for them, but when they express their gratitude by saying things like, “Thank you, teacher, now I can speak the language,” it makes me happy. However, teaching English in El Salvador can be challenging because not everyone likes the language.

Finally, Sheldon’s reflection on the challenges of teaching English in El Salvador, especially with students who struggle with the language, speaks to the perseverance required in teaching. The personal satisfaction derived from witnessing student progress underlines the emotional rewards tied to teaching, despite the obstacles faced. This satisfaction is what consolidates Sheldon’s career path choice.

The narratives above were grouped into specific codes that reflect how participants entered and embraced the teaching profession. As shown in Table 1, these codes fall under the category “Career Path” and are accompanied by their descriptions and representative statements.

Table 1. Career Path

Code	Description	Supporting statements
Serendipity and adaptability	Unexpected opportunities leading to career shifts.	Mary: “I was not applying for Amity but for a scholarship to study one semester at one of the universities in the United States. [...] Later, they called and offered me an internship, which I decided to take.”
Early informal teaching experiences	Initial non-official teaching roles fostering passion.	George: “When I was still a student at university, they had clubs where you could work with other students, helping them teach something. [...] Technically, I was teaching since my first year at university, but it wasn’t official, just for the clubs.” Mandy: “I started teaching at church when I was 15,” she shared. “Later, while pursuing my associate degree in English, I was asked to teach English to kids as well.”
Influence of inspiring teachers	Role models changing attitudes toward subjects or teaching.	Missy: “Since I was a kid, I had always wanted to be a teacher,” she shared. “At first, I didn’t like English and thought I’d be a math teacher. [...] I had a teacher who made me fall in love with the language.”
Shifts in subject preference	Adjusting career focus due to external factors like test scores.	John: “Since high school, I enjoyed being a teacher assistant and decided to pursue teaching as my major,” he explained. Although he initially dreamed of becoming a science teacher, his PAES test score wasn’t high enough, so he shifted to English.
Formal opportunities and scholarships	Structured programs solidifying teaching identity.	Connie: “During my fifth year, I got a scholarship for the AMITY program and worked as a teacher assistant in a Spanish immersion school in Minnesota for about 10 months.”

Code	Description	Supporting statements
		Jeff: "... until I took the Didactics III course at university. I had the opportunity to teach at a school in my hometown [...], where I conducted activities for fifth and fourth-grade students."
Personal satisfaction and challenges	Emotional rewards despite difficulties in teaching.	Sheldon: "I feel satisfaction when I see my students improve and learn throughout the process of acquiring a second language. [...] However, teaching English in El Salvador can be challenging because not everyone likes the language."

Theme 2: Interns' expectations on AMITY

The participants' stories expose a collective journey of personal growth and self-discovery influenced by their internship experiences in the U.S. Many entered the program uncertain about their roles and futures. Mary shared, "I didn't even want to be a teacher, but that experience [the internship] helped me better understand what I wanted to do. [...] Until I was there in the U.S., teaching kindergarteners, I knew I wanted to be a teacher." Her initial hesitation shifted to a clear passion for teaching, even though she now works with adolescents. This recurring theme demonstrates how immersive experiences can redefine professional aspirations.

George considered his initial concerns about communication during the internship, stating, "I didn't have many expectations. [...] My expectations were mostly related to how I was going to communicate with them or whether they would understand me." He anticipated speaking Spanish in school but worried about using English outside the classroom. This highlights the linguistic challenges participants faced, emphasizing their focus on effective communication as a critical aspect of their experience. George's reflection underscores how concerns about language use and comprehension shaped his expectations, illustrating the importance of adaptability in cross-cultural and multilingual settings.

Communication emerged as a central concern for participants, particularly regarding their bilingual experiences. George expressed apprehension about navigating interactions in both Spanish and English, a sentiment echoed by Jeff who found himself grappling with the complexities of language in diverse contexts. This concern underlines the critical role of effective communication in fostering connections and confidence within the classroom setting: "When you're studying an English major, you're expecting to teach English. [...] Still, it was going to be in an English environment, so it was useful for me anyway." Working with fourth graders, who alternated between Spanish and English instruction, provided valuable practice and demonstrates how bilingual teaching environments can broaden professional skills and enhance adaptability

Missy expressed:

My expectations were really high, and I achieved those expectations; it was way more than I was expecting. I remember that when I was studying at university, I had two teachers who were part of this program in the past. In class, they sometimes brought up that topic and talked about how that experience helped them become the teachers they are. That experience not only helped with their teaching careers but also in their personal lives. For example, if you had asked me before participating in this program, I wasn't that confident, independent, or sociable but because of my participation, I am now confident and independent; I've become more sociable and acquired many techniques and strategies that I'm implementing now when I'm teaching. It really was a nice experience!

To which John echoed:

Before, my main goal was to improve my English language skills. Being immersed in a different culture allowed me to learn about its traditions, customs, codes, and rules. This experience taught me that studying American culture is different from just reading about it; it's about living it! On a personal level, I improved my skills and learned from teachers' strategies that I can apply here. Although those strategies were originally in Spanish, I collaborated with partners to present them in a way that would help us prepare for graduation.

Finally, Sheldon shared:

Well, my purpose was to improve my skills in English. So, when I went to the United States, the first week was like I was in shock. Everything was equal, and the native speakers were different. How they spoke and how the teachers just conversed was striking. You learn the language through your teachers, but hearing native speakers is different. It's kind of difficult when you experience that.

These participants emphasized personal growth as a significant outcome of their experiences. They reported enhanced confidence, independence, and social skills, illustrating how the internship facilitated not only professional development but also personal enrichment. This growth aligns with Sheldon's reflection on the shock of engaging with native speakers, emphasizing the deep impact of cultural immersion on language acquisition and comprehension.

The mention of an "English environment" implies an awareness of the linguistic and cultural dynamics at play, where Spanish teaching occurs within a predominantly English-speaking framework. The acknowledgment of working with fourth graders introduces a specific age group, which may influence teaching methods and content delivery, particularly given the alternating month-long focus on Spanish and English.

Participants Connie and Mandy expressed diverse expectations about their internships, ranging from curiosity to the need for guidance. Connie stated, "When I started my internship here, I was expecting to learn how they teach here. [...] It was higher than my expectations." Mandy anticipated structured support, explaining, "I expected them to tell me how the system works, [...] then take me to the classroom." Their reflections emphasize the importance of mentorship and how experiences often exceed initial expectations, fostering deeper professional growth.

The expectations expressed by the participants were synthesized into codes that capture both their concerns and the growth they experienced. Table 2 summarizes the category "Interns' Expectations on AMITY.

Table 2. Interns' Expectations on AMITY

Code	Description	Supporting statements
Uncertainty and self-discovery	Entering with unclear roles but gaining clarity through experience.	Mary: "I didn't even want to be a teacher, but that experience [the internship] helped me better understand what I wanted to do. [...] Until I was there in the U.S., teaching kindergarteners, I knew I wanted to be a teacher."
Communication and language concerns	Worries about bilingual interactions and comprehension.	George: "I didn't have many expectations. [...] My expectations were mostly related to how I was going to communicate with them or whether they would understand me." Jeff: "When you're studying an English major, you're expecting to teach English. [...] Still, it was going to be in an English environment, so it was useful for me anyway."
Personal growth and confidence	Expectations of enhanced skills like independence and sociability.	Missy: "My expectations were really high, and I achieved those expectations; it was way more than I was expecting. [...] For example, if you had asked me before participating in this program, I wasn't that confident, independent, or sociable but because of my participation, I am now confident and independent."

Code	Description	Supporting statements
		John: "Before, my main goal was to improve my English language skills. Being immersed in a different culture allowed me to learn about its traditions, customs, codes, and rules."
Cultural and linguistic immersion shock	Initial challenges with native speakers and environments.	Sheldon: "Well, my purpose was to improve my skills in English. So, when I went to the United States, the first week was like I was in shock. Everything was equal, and the native speakers were different."
Mentorship and structured support	Anticipating guidance and exceeding expectations.	Connie: "When I started my internship here, I was expecting to learn how they teach here. [...] It was higher than my expectations." Mandy: "I expected them to tell me how the system works, [...] then take me to the classroom."

Theme 3: Interns' responsibilities

During their internship, participants experienced some responsibilities, which made them reflect and mature, molding their growth and professional development. Mary said that she had to assist in various daily activities:

I used to like helping in different activities during the day... Helped the kids. So, during three months, I was just getting used to the way the teacher taught and all the things that we used to do and all the things that she was in charge to do. I was just trying to help the kids to move from one place to another and try to repeat instructions. Then, I was in charge of the main activities, like being responsible for different activities depending on the subject, from math, language, or art. To take the kids to physical education and to music class. To help check their homework assignments.

Connie's commitment to working with those who were behind in their academic progress emerged in the following:

In the classroom, it was just me and the teacher with the kids every day. I guided the morning meeting and also managed their line as they returned to the classroom. During that time, I worked with small groups, particularly focusing on those who felt a bit left out or were a little behind the others. I had the opportunity to help these small groups improve.

The participants' statements illustrate complex engagement with their roles in the classroom, emphasizing their willingness to foster a supportive learning environment. A commonality across the narratives is the emphasis on student support and guidance, with participants expressing enjoyment in assisting children through various activities and transitions. This reflects a deep-seated dedication to ensuring students' smooth navigation of their educational experience.

George coined:

The students are always going to try to speak to you in English because they know that their main teachers would not let them speak in English in the class. So they say no matter if they are speaking to you in English, you always have to speak in Spanish. So technically, my main role for that was to speak in Spanish at all times and, from time to time, to prepare presentations related to cultural things from El Salvador. This way, I could explain what was also followed about, or things related to behaviors or cultures that we had here.

Furthermore, the importance of language emerges as an essential aspect of their roles, particularly the requirement to communicate predominantly in Spanish. This not only reflects the cultural and linguistic dynamics of the classroom but also highlights their role in creating an inclusive atmosphere that values students' backgrounds, as articulated by George. This language focus facilitates deeper connections between the participants and their learning experiences,

aligning with Vygotsky's (1978) sociocultural theory, which emphasizes the role of language as a tool for cognitive development and social interaction.

Missy's account demonstrates the multifaceted nature of her responsibilities during the internship. Each day, she prepared materials in the teacher's workroom, escorted students to lunch, and supervised them during breaks. Weekly bus duty involved ensuring students boarded safely and avoided traffic. Her teaching role varied by grade level. Reflecting on this, she stated, "In fourth grade, I barely had the chance to teach, but the teacher often gave me a small group of students to reinforce the topics she was explaining to everyone, so it was a form of personalized teaching".

Mandy described her teaching responsibilities, which involved teaching at least one period daily, though she often taught more, particularly in social studies, community, and science. Occasionally, she substituted for her mentor teacher when the latter was absent. Reflecting on this experience, Mandy explained, *"I think I kind of had a click with her and like, got to understand how she worked well. So, she liked what we planned together, so I knew what was going to happen the next day."* This rapport enabled Mandy to anticipate and adapt effectively to classroom needs, showcasing her growth in managing diverse instructional tasks.

The participants often took on varied responsibilities, from preparing materials and supervising students during breaks to conducting specific subject lessons, which indicates their adaptability and willingness to meet the diverse needs of the classroom. Missy's experience with bus duty and Mandy's role as a substitute teacher exemplify this flexibility.

John stated:

Inside the school, I was in the position of "auxiliary teacher." I was teaching four sections of 20 to 40 minutes at the beginning of the internship, and for the first two or three months, I had been observing how the teachers managed the class, controlled behavior, and created activities. They used different types of strategies, such as behavior charts, to manage various student needs, so we started learning how to manage those things. After the first two or three months, for another four months, I helped teachers with 20 to 40-minute sessions in subjects like math, reading, and science, depending on the grade and the teacher. Each teacher would decide, "Okay, you're going to help me here with math," or "You're going to help me here with reading centers," and then with independent reading. We worked together in groups and started helping the kids with reading comprehension.

Another significant aspect is the shift from observation to active participation in teaching roles, as another participant described transitioning from observing classroom management techniques to actively engaging in teaching and personalized instruction. For instance, John notes the initial period of observation before taking on teaching responsibilities, emphasizing the importance of learning effective strategies for managing diverse student needs.

Other participants shared their experiences supporting reading development, particularly in Spanish. Sheldon reflected on his role, stating, "I focused on helping them read fluently in Spanish and tried to explain some words that they probably didn't know the meaning of". Noting his emphasis on developing both fluency and comprehension during reading sessions of Spanish.

Similarly, Jeff explained, "I was in charge of helping the students with reading comprehension in Spanish. So, I had to go to the school's library...to check what would be the best books for them to read". He demonstrated his proactivity when selecting appropriate reading materials aligned with students' literary needs.

Both participants emphasized a commitment to fostering an engaging and supportive reading environment. Sheldon focused on ensuring students' cognitive engagement with texts, while Jeff demonstrated adaptability by managing both instructional and supportive tasks, such as preparing materials and curating resources. These roles reflect the diverse responsibilities interns undertake, often bridging instructional support and active facilitation.

However, challenges in role clarity were evident. Jeff expressed that there were moments when he felt less actively engaged, mentioning, "There were a couple of things in which I wasn't doing anything, basically, like helping any students. I was just helping the teacher". This dynamic illustrates the oscillation between roles as interns navigate responsibilities and adjust to varying classroom demands.

These accounts highlight the significance of reading fluency and comprehension within participants' responsibilities, emphasizing both their impact on student learning and the interns' professional growth. Their reflections align with Vygotsky's (1978) sociocultural theory, which underscores the role of interactive and contextual learning in cognitive development.

Participants also described the variety of tasks and responsibilities they assumed during their internships. These were organized into codes that highlight classroom support, teaching roles, and challenges in role clarity. Table 3 presents the category "Interns' Responsibilities," showing the codes, their descriptions, and illustrative quotations.

Table 3. Interns' Responsibilities

Code	Description	Supporting statements
Daily assistance and student support	Helping with routines, transitions, and small groups.	Mary: "I used to like helping in different activities during the day... Helped the kids. [...] I was just trying to help the kids to move from one place to another and try to repeat instructions." Connie: "I guided the morning meeting and also managed their line as they returned to the classroom. During that time, I worked with small groups, particularly focusing on those who felt a bit left out or were a little behind the others."
Language and cultural facilitation	Maintaining Spanish use and sharing cultural insights.	George: "The students are always going to try to speak to you in English [...] So technically, my main role for that was to speak in Spanish at all times and, from time to time, to prepare presentations related to cultural things from El Salvador."
Supervisory and preparatory tasks	Material preparation, supervision, and bus duty.	Missy: "Each day, she prepared materials in the teacher's workroom, escorted students to lunch, and supervised them during breaks. Weekly bus duty involved ensuring students boarded safely and avoided traffic."
Active teaching and substitution	Leading lessons in subjects like social studies or science.	Mandy: "I think I kind of had a click with her and like, got to understand how she worked well. [...] I knew what was going to happen the next day." (Referring to planning and teaching periods.) John: "After the first two or three months, for another four months, I helped teachers with 20 to 40-minute sessions in subjects like math, reading, and science."
Reading development support	Focusing on fluency, comprehension, and material selection.	Sheldon: "I focused on helping them read fluently in Spanish and tried to explain some words that they probably didn't know the meaning of." Jeff: "I was in charge of helping the students with reading comprehension in Spanish. So, I had to go to the school's library...to check what would be the best books for them to read."
Challenges in role clarity	Periods of underutilization or oscillation in engagement.	Jeff: "There were a couple of things in which I wasn't doing anything, basically, like helping any students. I was just helping the teacher."

Theme 4: Interns' recommendations on AMITY

After living their AMITY experience, interns share some highlighting recommendations related to the program from their perception. This also provides a reflection addressed to current and future applicants to embrace the advantages of this professional development process.

The participants' reflections on their internship program reveal a collective emphasis on cultural immersion, personal growth, and transformative teaching philosophies. These are some highlighting citations concerning what they perceived living this experience aligned with the reasons why they recommend the program to future applicants. Hence, this reflects Vygotsky's (1978) sociocultural theory, which emphasizes the importance of social interactions and cultural experiences as essential factors in cognitive development and personal transformation.

Mary shared a reflection on her cultural experience, saying, "It was the first time living for a year in another country...to know that there are people with another way of living, another way of thinking, another way to do things". This highlights the personal growth gained through exposure to different cultures.

George expressed, "It helps you understand other cultures better and practice the language...speaking with a native speaker is not the same as practicing with people who learn to speak in another country". This emphasizes the value of immersion for cultural and linguistic development.

John noted the dual cultural and linguistic benefits of the program, stating, "I was learning many things in Spanish that I didn't know...comparing Latin American culture with your original traditions...you're going to be immersed; you're going to be pushed to learn". This illustrates the enriching experience of learning both the language and the cultural context in which it is used.

These narratives reflect the profound impact of cultural immersion in educational programs, where participants not only learn the language but also deeply engage with diverse cultural perspectives. Their experiences underscore the importance of such programs in expanding global awareness and enhancing both linguistic and personal growth.

For example, these participants articulate the significance of experiencing diverse cultures and languages, highlighting the distinction between learning from native speakers and non-native speakers. This theme of cultural understanding and language practice is echoed in John, who mentions learning about both Spanish and Latin American cultures, reinforcing the dual impact of language and cultural exploration.

Connie reflected on her evolving view of teaching, emphasizing the significance of professional growth through the internship:

My overall opinion of the internship program is that it was really meaningful to my professional development. I used to believe that I wanted to teach in public schools here in El Salvador. For me, a teacher who explained the class, gave tests, and conducted activities like those was a real teacher, the best teacher. But when I realized that there are different ways to teach, and that it does not always have to be the teacher who is the center of the class...

Connie's quote reveals a transformative experience in her understanding of pedagogy, marking a shift from traditional to more student-centered teaching methods, which contributed significantly to her professional development.

Sheldon shared his recommendation for the internship program, emphasizing its positive impact on both his career and the opportunity to engage with a new culture:

Yes, I definitely recommend applying to these programs. Now, as a teacher at the university, I talk to my group of students about my experience, and they are motivated by it. Last year, one of my students at the university applied to this program, and I think they are currently in the United States. I'm not sure, but I believe it's a girl and a boy. For me, applying to these kinds of programs is a great experience because you have the opportunity to learn about a new culture

Sheldon highlights the value of cross-cultural exchange and its potential to inspire students, emphasizing the program's influence on both personal and professional levels.

Jeff also recommended the program, while offering a nuanced perspective on the potential variability in experiences based on the school's environment:

I will definitely recommend it. However, I recognize that when someone else goes to a different school, the rules might be different, and they might not have the opportunity to practice both languages. I would just advise being aware that this can happen or that this could be another possibility as well.

Jeff acknowledges the variability in program experiences, suggesting that while the program is valuable, future participants should be prepared for differences in language usage and school culture.

These participants highlighted important reasons why to recommend the program. For instance, Connie shares insights into how the program not only bolstered her teaching skills but also fostered confidence and independence, signaling a shift in her identity as an educator. The move away from traditional teaching paradigms, as discussed by Connie, aligns with Sheldon's emphasis on the program's motivational aspect, inspiring students to seek similar opportunities. Meanwhile, Jeff reflects on logistical comforts and the chance to practice multiple languages, illustrating the practical benefits of the experience.

Mandy reported:

I think that even the bad things are worth it. Having racism around may not be nice and doesn't feel good, but it helps us to grow. So, I think there is nothing that I could say that would suggest otherwise. I would say no matter what, go.

Lastly, this participant acknowledges the presence of challenges, such as racism, while framing these experiences as opportunities for growth.

Collectively, these narratives highlight the profound, multifaceted impact of the internship program on participants' professional and personal lives, promoting a holistic resilient understanding of education as an evolving process influenced by cultural dynamics.

Finally, the participants provided recommendations based on their lived experiences, emphasizing cultural immersion, pedagogical growth, and challenges. Table 4 summarizes the category "Interns' Recommendations on AMITY," including the relevant codes, descriptions, and supporting statements.

Table 4. Interns' Recommendations on AMITY

Code	Description	Supporting statements
Cultural immersion and awareness	Exposure to diverse ways of living and thinking.	Mary: "It was the first time living for a year in another country...to know that there are people with another way of living, another way of thinking, another way to do things." George: "It helps you understand other cultures better and practice the language...speaking with a native speaker is not the same as practicing with people who learn to speak in another country." John: "I was learning many things in Spanish that I didn't know...comparing Latin American culture with your original traditions...you're going to be immersed; you're going to be pushed to learn."
Professional and pedagogical growth	Shift to student-centered teaching and skill enhancement.	Connie: "My overall opinion of the internship program is that it was really meaningful to my professional development. [...] But when I realized that there are different ways to teach, and that it does not always have to be the teacher who is the center of the class..."
Motivational impact on others	Inspiring students to apply based on shared experiences.	Sheldon: "Yes, I definitely recommend applying to these programs. Now, as a teacher at the university, I talk to my group of students about my experience, and they are motivated by it."

Code	Description	Supporting statements
Awareness of variability and challenges	Preparing for differences in schools and potential issues like racism.	Jeff: "I will definitely recommend it. However, I recognize that when someone else goes to a different school, the rules might be different, and they might not have the opportunity to practice both languages." Mandy: "I think that even the bad things are worth it. Having racism around may not be nice and doesn't feel good, but it helps us to grow. So, I think there is nothing that I could say that would suggest otherwise. I would say no matter what, go."

4. Discussion

The development of this research study highlights aspects related to the perception of lived experiences of Salvadoran English language teacher candidates who participated in different cohorts of the AMITY program in some immersion schools in the United States of America. As described throughout this paper, all students manifested a positive perception in their personal, academic, and professional growth. This research's results and main findings provide a wide-open overview of the benefits this program offers to university students who apply to have this experience abroad and to uplift the ELT profession in the Salvadoran context.

Our findings highlight a positive perception of interns regarding the AMITY program, aligning with the principles of experiential learning, where hands-on experiences significantly contribute to the development of practical skills (Kolb, 1984; Miettinen, 2021). Among their expectations, the interns reported developing teaching skills for working with kindergarten students, a level they are not typically prepared for in their university courses. This supports Vygotsky's (1978) concept of the Zone of Proximal Development (ZPD), where they could expand their capabilities through practical exposure and guidance from experienced teachers (Yin, 2023; Beckett, Hager, 2002). The participants also emphasized the meaningful support from the university, schoolteachers, and the local community, which reflects the importance of a robust social support system in enhancing professional growth (Lave, Wenger, 1991; Beckett, Hager, 2002). This aligns with social constructivist theories, suggesting that learning is mediated by social interactions and collaboration (Vygotsky, 1978; Li, Wang, 2022). For example, interns frequently reflect on how interactions with mentors and other interns who shared similar sociocultural backgrounds helped them develop teaching strategies and adapt to new educational systems.

Another significant finding was that the interns were frequently engaged in code-switching, using both their native language (Spanish) and their target language (English). This mirrors research by Macaro (2005), who argues that code-switching can be a strategic tool in language learning, particularly in bilingual contexts. The interns reported that while they were allowed some flexibility to use Spanish in their classes, their primary focus remained on teaching and practicing English, contributing to their bilingual proficiency and cultural immersion. Recent studies further reinforce the role of bilingual practices in strengthening intercultural competence (Yin, 2023).

Moreover, the interns described the experience as enriching for their professional journey, particularly regarding their progress in teaching methodologies and adaptability in diverse educational contexts. This resonates with the concept of reflective practice (Schön, 1983; Fook, 2023), where individuals critically evaluate their experiences to inform future professional actions. In addition, they noted how their routines ranged from simple tasks like printing or copying documents to more complex activities such as preparing lessons and supporting schoolteachers. These varied responsibilities are reflective of apprenticeship models (Lave, Wenger, 1991; Beckett, Hager, 2002), where novices gradually take on more challenging tasks under the mentorship of experienced practitioners.

Eventually, the interns emphasized that their primary role involved teaching and practicing their native language, alongside immersing themselves in the host culture. Such immersion experiences are known to foster intercultural competence and adaptability, which are crucial for future educators working in globalized environments (Bennett, 1993; Li, Wang, 2022). The overall

experiences illustrate the benefits of the AMITY program in providing a platform for interns to explore different educational settings, enriching their personal and professional growth.

Finally, the results from this paper provide a wide overview of the teacher candidates' perception of the AMITY program, and how this project marks and shapes interns' lives from their careers until they are immersed in systematic institutional teaching procedures. Therefore, they acquire all the required skills to take the teaching beyond the demanding level in their natural and social setting. In addition, considering the interviewees' descriptions, these outcomes are compared with the results presented in the research study developed by Antropova et al. (2019). In their qualitative interpretative phenomenological analysis, they emphasize that the interns' responses were extremely positive in aspects concerning the intern's personal and professional growth. They, moreover, continue explaining that it is clear that living and job training abroad significantly impacted participants' lives and greatly influenced their outlook on life in general. In exchange programs with a bilingual and dual immersion context, by engaging in purposeful, culturally mediated activities, AMITY interns acquired new teaching skills and developed professional identities that are enriched by their interactions within these dynamic contexts.

From a hermeneutic perspective, immersion into systematic institutional teaching procedures can be interpreted as a rite of passage where the interns transition from theoretical knowledge gained in their university courses to practical, hands-on experience in real-world educational settings. Gadamer's (2004) concept of the "fusion of horizons" is particularly relevant here, as the teacher candidates' prior understandings are reshaped and expanded through their participation in the program, allowing them to integrate their existing knowledge with new experiences gained in diverse classrooms. This interpretative transformation reflects how the interns' perceptions are not static but are continually shaped by the socio-cultural contexts they engage with, ultimately preparing them to navigate and thrive in demanding teaching environments (Lambeth, Smith, 2016).

Moreover, the program's impact extends beyond acquiring technical skills; it profoundly influences how interns perceive their roles within their natural and social settings. Through hermeneutic analysis, the AMITY program can be seen as a structured yet dynamic space where teacher candidates learn the mechanics of teaching and internalize a deeper sense of purpose and responsibility towards their students and communities. The notion of "hermeneutic self-understanding" (Ricoeur, 1992) suggests that as these interns immerse themselves in varied educational contexts, they undergo self-reflection and reinterpret their professional identities. This experience allows them to align their values with their teaching practices, thus taking their pedagogical approach to a level that transcends mere technical proficiency. By engaging with both the natural (e.g., classroom dynamics) and social (e.g., community support) elements of their teaching environments, these candidates cultivate a holistic teaching philosophy that is responsive to the needs of their students and the broader educational landscape (Beckett, Hager, 2002; Fook, 2023).

Therefore, the theoretical gap concerning the problem has been presented and solved; nevertheless, for future studies, researchers should focus on determining the interns' lived experience based on teaching methods and approaches abroad.

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6. Conflict of interest

We have no known conflict of interest to disclose.

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An Analysis of VOS Viewer-Based Digital Resources in Higher Education

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Abstract

With the continuous advancement of global digital transformation, digital resources have been increasingly used in teaching, economics, management and other fields, and have become an important tool to improve the quality of education, promote the integration of disciplines and promote educational equity. Using VOS viewer, this study analyses the keyword co-occurrence, clustering and temporal evolution of digital resources literature in the Web of Science (WOS) database over the past five years to reveal the research focus and development trend of digital resources in higher education. It is found that the application of digital resources in higher education focuses on four main areas: (1) online education and educational equity; (2) the reshaping of educational models by technological innovation; (3) the support of digital resources for the Sustainable Development Goals (SDGs); and (4) interdisciplinary research and collaboration. However, resource quality assessment, cultural appropriateness and data privacy issues remain major current challenges. By collating and analyzing the classification and application of digital resources, this study highlights the need for interdisciplinary collaboration and international resource sharing, and makes recommendations to further optimize the design of resources and improve educational equity. The study provides a theoretical basis for policy makers and educators, among others and indicates a path for the direction of future research on digital resources in higher education.

Keywords: digital resources, higher education, digital transformation, visual analytics.

1. Introduction

The digital transformation of higher education has accelerated significantly in recent years, and digital resources have become indispensable tools for improving the quality of education and promoting educational equity. The popularity of online courses, Open Educational Resources (OER) and virtual laboratories has changed the traditional teaching and learning model and

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created new opportunities for personalized education (Radmehr et al., 2024). However, despite the rapid development and widespread use of digital resources, there is little research on digital resources in higher education and relatively few systematic analyses of research hotspots and emerging trends.

The digital transformation of education has affected and changed teaching and learning practices. Digital educational resources have become important tools to support personalized learning and improve the effectiveness of teaching and learning, including online services, mobile applications and artificial intelligence platforms, which facilitate activities such as assessment and creative learning (Siemens, 2013). The Covid-19 pandemic further highlights the critical role of digital resources in maintaining educational continuity during exceptional periods (Sanz-Labrador et al., 2021). Advances in the digitalization of education optimize the teaching and learning process and develop students' competences. (Antón-Sancho et al., 2021).

Despite the great potential of digital educational resources, there are significant challenges to their effective use. Accessibility issues, especially in less technologically developed areas, remain a barrier to equitable distribution of resources. In addition, cultural adaptation, data privacy issues and the digital divide also hinder digital transformation to some extent (García et al., 2023; Cao et al., 2024; Zhao et al., 2024). Teachers' digital literacy and professional development are also crucial to ensure seamless integration of resources into the educational environment (Heine et al, 2023; Wang et al, 2023; Asante, Novak, 2024; Trgalová, Tabach, 2024).

This study uses the bibliometric and visualization tool VOS viewer to systematically analyze the classification, applications and challenges of digital resources, focusing on their role in higher education. This study aims to (1) identify key research areas of digital resources in higher education, including online education and equity, technological innovation, sustainability and interdisciplinary studies; (2) discover the links between these areas and their wider implications for the education system; and (3) highlight existing challenges and future directions.

The theoretical significance of this study is to contribute to the construction of a comprehensive knowledge framework for digital resources in higher education, while the practical significance is to provide actionable insights for stakeholders, such as policy makers and educators, to optimize the development and application of resources. The results of the study can inform strategies to bridge the digital divide, improve the quality of resources and promote equitable educational opportunities globally.

2. Literature Review

The emergence and development of digital resources has changed the traditional teaching methods and become an integral part of higher education. With the advancement of technology, digital resources play a key role in innovating pedagogy, facilitating resource sharing and addressing sustainable development.

As the global level of technology continues to advance, digital resources are increasingly being used in modern education, especially in higher education. Since the outbreak of the Covid-19 pandemic, there has been a massive increase in research on online education, and digital resources have become an essential teaching tool for teachers (Tang, 2021). Some researchers have categorized digital educational resources to include online services, mobile applications, digital environments and interactive tools (Akhmetshin et al., 2019).

Digital technology has an important role in facilitating the sharing of resources in higher education (Xie, Zhang, 2024). Co-created digital resources in nursing education increase student engagement and knowledge retention by meeting specific pedagogical requirements (Laugaland et al., 2023). Similarly, digital collaborative writing platforms play an important role in facilitating active learning for multilingual students (Pennington et al., 2024). When using digital devices in the classroom, problems with asymmetric access can be effectively addressed through multimodal digital resources when they occur (Vänttinen, 2024).

Emerging trends emphasize co-creation, interdisciplinary integration and sustainability in the development of digital resources. Co-design is particularly necessary for nursing students, and the importance of knowledge sharing and effective communication cannot be overlooked (Nuala et al., 2024). Interprofessional education promotes peer learning, personal growth, teamwork and communication (Cook et al, 2024). In addition, the deep integration of higher education and digital technology is an inevitable trend, assessing higher education and digital infrastructure

development is important to promote the regional integration of higher education and the sustainable development of higher education (Xie, Zhang, 2024).

Despite the rapid development of digital resources, some challenges remain. Digital resources often need to be adapted to different cultural and regional contexts, for example tools designed for Norwegian nursing students need to be adapted to Spanish and UK contexts (Laugaland et al., 2023). The digital divide is a significant barrier, especially in deprived areas, where differences in infrastructure and access limit the availability of digital resources (Barnes, Tour, 2023). Educators, in turn, are unable to effectively integrate digital resources into their practice if they lack adequate training (Pennington et al., 2024).

To address these challenges, policymakers must prioritize the factors of equitable access, cultural adaptability and data privacy protection (Veletsianos, 2021; Zhao et al., 2024). Encouraging interdisciplinary collaboration and co-creation of digital resources can increase their relevance and effectiveness (Laugaland et al., 2023; Barnes, Tour, 2023). In addition, combining digital tools with the concept of sustainable development is conducive to further promoting the modernization of national governance systems and the process of sustainable development (Xu et al., 2024).

In conclusion, digital resources hold great potential to accelerate the development of higher education by fostering innovation, collegiality and sustainability. Addressing barriers to cultural adaptability, data privacy protection and faculty literacy training is also critical. However, by utilizing interdisciplinary collaboration, co-creation and innovative teaching and learning strategies, digital resources can continue to reshape education and provide more equitable and efficient learning environments (Yañez et al., 2023).

3. Methodology

In this study, we searched the Web of Science core dataset on 25th December 2024 for the last 5 years. The search term was 'digital resources', and the search was limited to subject search SSCI. 9189 documents that met the requirements were imported into the VOS viewer, and the year of publication, the country (region) of the authors and the distribution of institutions were statistically analyzed. Its research status and hotspots were analyzed through visualization. Analyze research status, hot spots and trends through visualization results such as keyword node size, thickness of lines between keywords and color distribution.

After importing the literature into the VOS Viewer software, the keyword threshold was set to 50 occurrences. Cluster analysis was performed on keywords that met the requirements, generating a visual keyword co-occurrence network map. In "Network Visualization" (e.g. Figure 5), circles and labels form a keyword element. The larger the node, the more frequent the keyword appears. Furthermore, the connecting line represents the strength of the relationship between the two nodes; the stronger the connection between the keywords, the thicker the line. VOS Viewer also categorizes similar keywords within a research field using different colors. Users can clearly see the specific keywords in each cluster from the "Item" tab, thereby discovering the similarities and differences between current research hotspots and research topics.

In the "Overlay Visualization" visualization (e.g. Figures 3 and 4), time is factored in. Different colors correspond to the years in which the keyword appeared. Bluer colors indicate earlier appearances, while yellower colors indicate later ones. The longer the average duration of a keyword's appearance in a given year, the larger the node.

4. Results and Analyses

The Web of Science core dataset was searched for literature published in the last five years (2020.1.1-2024.12.25) about digital resources, excluding duplicates and ineligible literature, finally 9189 documents were included in the analysis.

4.1. Trends in issuance and annual distribution

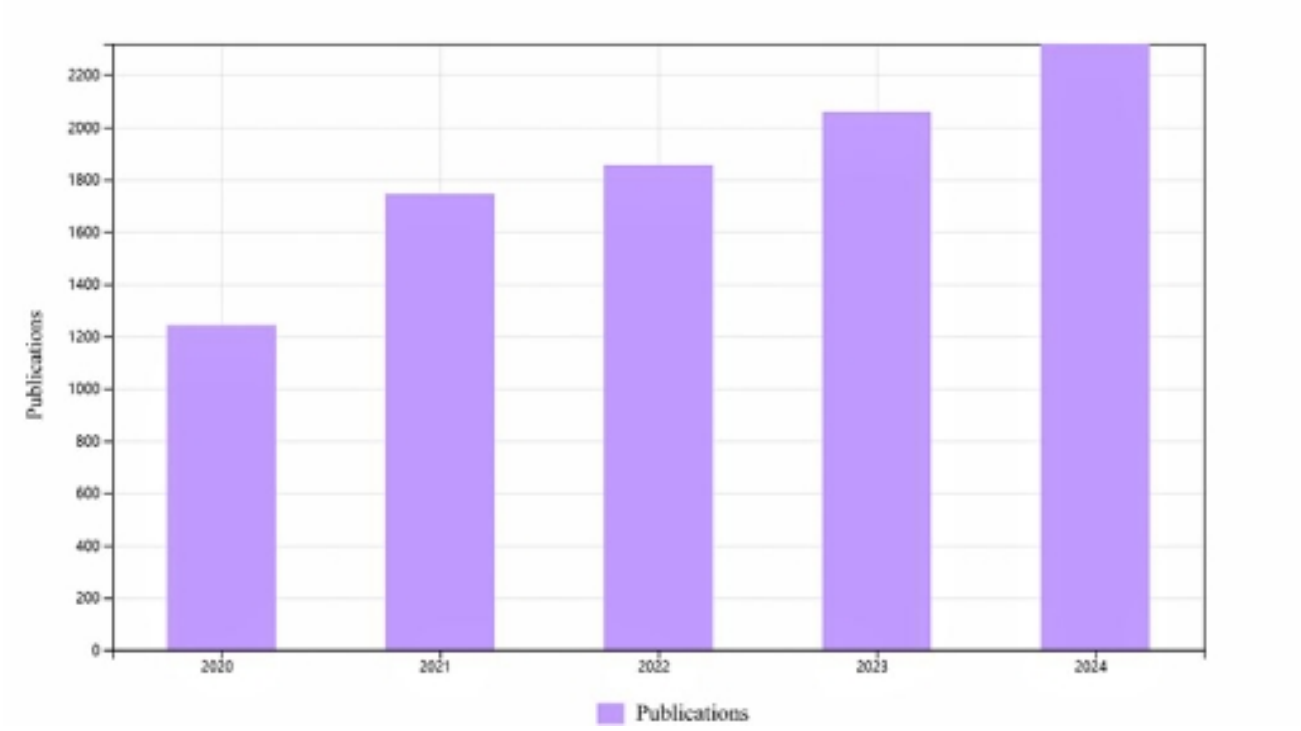

Fig. 1. Yearly Distribution of Literature Published on Digital Resources in the Web of Science Core Dataset (2020–2024)

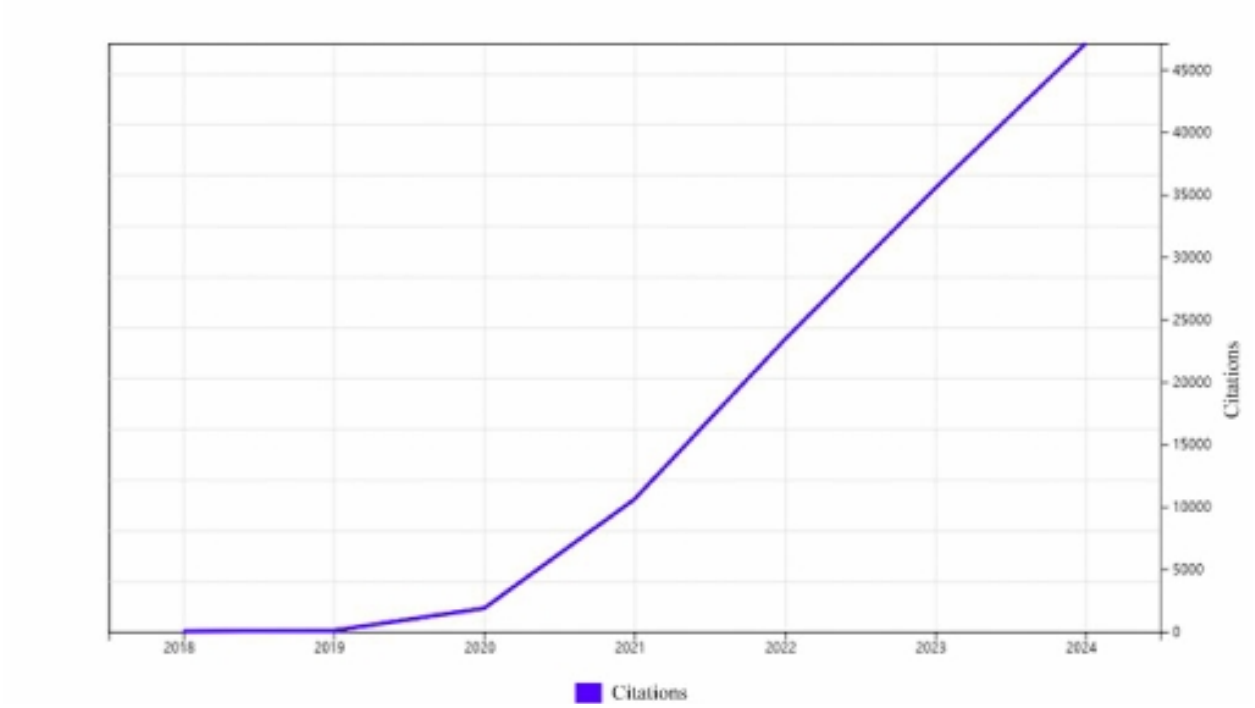

Fig. 2. Annual Citation Frequency of Literature Published on Digital Resources in the Web of Science Core Dataset (2020–2024)

Figures 1 and 2 show the trends in the number of publications and citations for digital resources published in the Web of Science Core Dataset over the past five years. Both the number of publications and the number of citations show a year-on-year upward trend. Figure 1 shows a significant increase in the number of articles related to digital resources in 2021. The data shows that the number of publications in 2020 was 1281, while the number in 2021 was 1775, an increase of 494 articles compared to 2020.

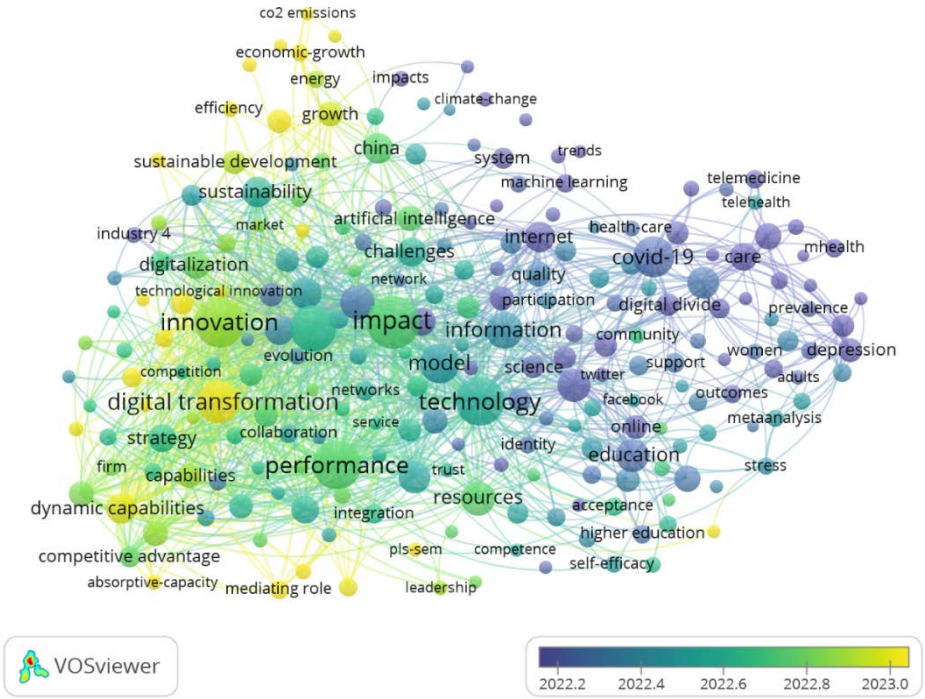

Fig. 3. Overlay Visualization of Digital Resources

As shown in Figure 3, blue indicates keywords that appeared earlier, while yellow indicates newer research hotspots. As shown in Figure 3, research hotspots in recent years have shifted from the covid-19 pandemic and social media to technology, management and innovation, ultimately to digital transformation. These major research hotspots are all resource-related. We also observed a surge in publications related to digital resources in 2021, driven by the covid-19 pandemic.

4.2. Authors

There are 9189 publications from 33523 scholars, of which the top three authors are Sascha Kraus (13), Vikram Patel (12), and Lu Feng (11). Sascha Kraus focuses on business management topics such as strategy and entrepreneurship, Vikram Patel specializes in interdisciplinary global mental health research, and Lu Feng focuses on macroeconomics and economic development, especially in China.

4.3. Issuing Countries

9189 papers were published from 156 countries and regions. Table 1 shows the top ten countries in terms of publication volume. The top three countries in terms of publication volume are China (2417 papers), the United States (1830 papers), and the United Kingdom (1058 papers).

Table 1. Ranking of the top 10 countries in terms of number of publications

Country	**Number of articles issued**
CHINA	2417
USA	1830

Country	Number of articles issued
ENGLAND	1058
AUSTRALIA	703
SPAIN	632
GERMANY	621
ITALY	469
CANADA	463
INDIA	310
NETHERLANDS	287

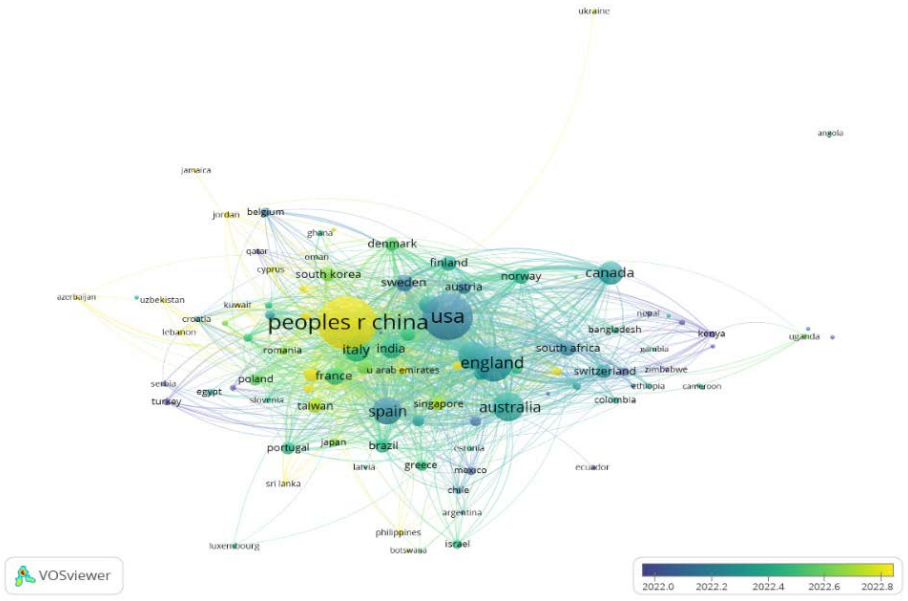

Fig. 4. Overlay Visualization of Issuing Country

Figure 4 shows that China collaborates closely with the US, UK and Germany. However, China's overall publication time is slightly later than that of the UK, US and other countries. Countries like Turkey, Jordan and the Philippines are relatively marginalized.

4.4. Issuing Organizations

According to the WOS core database, 9189 documents come from a total of 8624 organizations. The top ten organizations in terms of the number of issued papers are shown in Table 2. The top three organizations in terms of the number of articles issued are the University of London, the Chinese Academy of Sciences and the University of California system in that order.

Table 2. Ranking of the Top 10 Issuing Organizations

Organizations	Number of articles issued
UNIVERSITY OF LONDON	266
CHINESE ACADEMY OF SCIENCES	211

UNIVERSITY OF CALIFORNIA SYSTEM	160
HARVARD UNIVERSITY	120
UNIVERSITY OF TORONTO	109
WUHAN UNIVERSITY	107
UNIVERSITY COLLEGE LONDON	104
MONASH UNIVERSITY	99
UNIVERSITY OF MELBOURNE	98
UNIVERSITY OF OXFORD	98

4.5. Keywords

After importing the retrieved literature that meets the requirements into the VOS viewer software, a total of 31394 keywords were detected, and 229 keywords with a frequency of occurrence ≥ 50 were detected. Among them, innovation (749 times), impact (842 times), performance (706 times), technology (709 times), management (654 times), digital transformation (521 times), information (402 times), model (466 times), Covid-19 (492 times), resources (352 times).

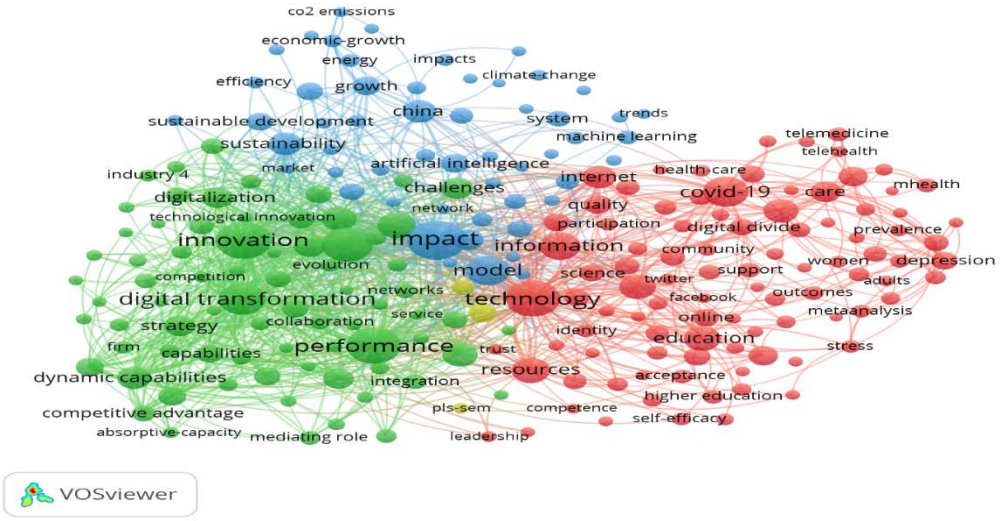

Fig. 5. Network Visualization of Digital Resources

Larger nodes indicate a higher frequency of keyword occurrence, such as “covid-19” “impact” and “digital transformation”. Thicker lines indicate closer connections between keywords. Research areas with similar characteristics share the same color. Therefore, as shown in Figure 5, the application of digital resources in fields such as education, economy and environment presents multi-dimensional hot topics and research trends, which can be roughly divided into the following four directions:

4.5.1. Education and Social Impact

The red clusters have keywords such as “online” “education” “higher education” “information” “technology” and “covid-19”, which demonstrate the core themes of digital resources in education, indicating that research in this field focuses on educational equity and the application and challenges of online education models, the acceptance of online education, and the impact of the digital divide on educational equity. Key directions for research include exploring the effects of

online education and blended learning, and how digital resources can be optimized to enhance the overall efficiency and utility of higher education (Hehir et al., 2021; Aguirre et al., 2022).

4.5.2. Technological innovation and digital transformation

The green cluster has keywords such as “technological innovation” “digital transformation” “performance” and “dynamic capabilities”, reflecting the wide application of digital technology in industries and organizations. Research in this area focuses on digital transformation in education and business driven by technological innovation, analyzing how digital resources can enhance competitiveness and optimize resource outcomes (Gabriele et al., 2024; Anna et al., 2023). In the field of higher education, research has focused on the transformative effect of digital technologies on teaching and learning models, such as optimizing teaching and learning processes through adaptive learning systems and learning management platforms. In addition, the field has explored the cross-cutting value of technological innovations in industries other than education, such as healthcare and business management (Ravik et al., 2024).

4.5.3. Environment and Sustainability

The blue clusters with keywords such as “sustainability” “climate change” “energy” and “efficiency” demonstrate the application of digital resources and technologies in the field of environment and sustainable development. Research has shown that digital resources and technologies have an important role to play in supporting environmental protection, energy efficiency and the realization of the Sustainable Development Goals (SDGs). For example, universities can produce sustainable OER courses that empower students to co-produce OERs about sustainable development (Braßler, 2024). Future research should further explore how technology and education can synergize to promote sustainable development in education, economy and environment.

4.5.4. Interdisciplinary research and collaboration

Core keywords such as “impact” “technology” “model” and “resources” have a large number of nodes on the co-occurrence network graph, indicating that digital resources research has a strong This indicates the strong interdisciplinary nature of digital resources research. From education and technology to economy and environment, researchers have analyzed the impacts of digital resources by constructing multi-disciplinary collaborative models, promoting interdisciplinary innovation. This direction emphasizes the integrated role that digital resources play at the intersection of education, industry and environment, and future research needs to further integrate multiple factors of technological innovation, policy making and educational reform to provide scientific support for educational ecology and social development (Ng et al., 2023).

The keyword co-occurrence network diagram reveals a wide range of applications of digital resources and technologies and their interactions in education, industry and environment. Future research needs to focus on the following areas: improving the efficiency and equity of digital educational resources and promoting innovation in online education models; exploring in depth the role of innovation in supporting business performance enhancement, environmental sustainability, and the transformation of education by digital transformation; and integrating the roles of digital resources in the fields of education, the economy and the environment from a cross-disciplinary perspective, to provide a scientific basis for policymaking and educational practice. Such comprehensive research will provide a more holistic perspective for achieving digital transformation in education and sustainable social development.

4.6. Application of digital educational resources in higher education

The application of digital educational resources in higher education covers a wide range of aspects such as teaching, student learning, faculty development and educational management, providing strong support for the digital transformation of higher education (Trouche et al., 2020). In the field of teaching, online courses (e.g., MOOCs) and blended teaching models have become common forms of application, providing students with flexible learning paths (Yao, 2023). Meanwhile, the introduction of virtual labs and multimedia teaching resources has enhanced the quality and interest of teaching practice, but the problems of insufficient interactivity and lack of authentic experience still need to be addressed. In addition, the instruction received by students incorporates e-learning resources that can be tailored to meet students’ unique learning needs through a customized approach, and the Personalized, Evidence-Based, and Inclusive Learning (PEBIL) model can address the disparities in digital teaching and learning (Hassoulas et al., 2023).

In student-directed learning, digital educational resources reduce the cost of learning and support educational equity through open educational resources (OER). Students use these

resources to independently assess learning outcomes and obtain immediate feedback. However, the variable quality of resources, the way they are accessed, and their potential ethical issues may affect learning outcomes (Zhou, 2024). On the teacher side, HEIs are using digital tools to support curriculum design and teacher training to improve the science and relevance of teaching content. Through data-driven analyses, teachers are able to understand students' learning progress and adjust teaching strategies in real time, which is positive in enhancing teaching effectiveness (Siemens, 2013).

In higher education management, learning management systems (LMS) and educational big data analytical tools have been widely used for resource integration and teaching decision-making. LMS enables centralized management of teaching content, while educational big data provides a scientific basis for teaching resource optimization and academic risk prediction through quantitative analysis of learning behaviors. Nonetheless, the complexity of these systems and their technical adaptability impose high requirements on university faculty and students, requiring further improvements in technical support and user training (Wang et al., 2023).

In conclusion, digital educational resources play an important role in teaching mode innovation, personalized learning path support and educational equity promotion in higher education. However, its application still needs to address the challenges of resource quality assessment, technology adaptation, and data privacy protection. Future research should focus on the long-term effects of digital educational resources in higher education and their deep integration with artificial intelligence and educational big data to support the realization of the overall improvement of education quality (Hashim et al., 2022; Sarva et al., 2023).

5.Discussion

5.1. Differences in digital resource application

Different disciplines experience varying learning outcomes when using digital resources. Disciplines with strong practical, highly structured and simulation-based learning experiences are particularly effective, such as anatomy, clinical skills and computer science (Frøiland et al., 2023). However, the effectiveness of digital resources may be limited in disciplines that prioritize emotional connection, in-depth discussion and critical thinking, such as philosophy and performing arts.

5.2. Limitations of digital resource application

Certain developing and underdeveloped regions, such as Turkey, Jordan and the Philippines, are significantly marginalized in the atlas (e.g. Figure 4). This suggests that promoting digital resources in these countries and regions may face significant challenges, such as insufficient infrastructure, limited funding and uneven resource quality, leading to inefficient or even impossible application (Puiu et al., 2023).

Therefore, digital resources should be designed more specifically, distributed more equitably, and promoted more rationally, based on the characteristics of different disciplines and the development of different countries and regions. In the future, we should also pay more attention to “how to customize digital resources to cultivate students’ abilities according to the characteristics of different subjects” “how to design low-cost, highly adaptable solutions for resource-poor areas”, and “how to establish and improve the support system for the application of digital resources to maximize its application effect while minimizing its risks”.

6. Conclusion

This study uses VOS viewer to analyze the articles on digital resources in the past five years, to show the research overview, hotspots and trends of digital resources from multiple perspectives, and finds that China ranks first in terms of the number of articles, and that the University of London, the Chinese Academy of Sciences, the University of California, and the scholars Sascha Kraus, Vikram Patel, and Lu Feng are more influential. Digital educational resources have become an important part of modern education and are widely used in education, economics and management. These resources, which include online courses, adaptive learning platforms and Open Educational Resources (OER), have excelled in improving the quality of teaching and learning, supporting the design of personalized learning paths and optimizing educational assessment. In addition, digital resources play a key role in teacher professional development, facilitating collaboration and reflection on teaching and learning. The convergence of technologies such as Artificial Intelligence (AI), big data analytics and Virtual Reality (VR) has injected new

vigor into digital education resources. AI-driven adaptive learning enables real-time adjustments to teaching content and enhances learning efficiency, while VR technology provides innovative scenarios for virtual labs and simulated practices. However, the application of digital educational resources still faces multiple challenges, including the lack of a resource quality assessment system, insufficient cultural appropriateness, educational equity issues arising from the digital divide, and data privacy and ethical risks. Future research should focus on optimizing intelligent and personalized educational resources, promoting data-driven education policymaking, and facilitating international resource sharing to achieve educational equity. In addition, the establishment of effective ethical and legal frameworks to regulate data privacy and AI technologies will contribute to the sustainable development of digital educational resources. Through technological innovation and policy support, digital education resources will play a greater role in promoting education quality improvement and global education equity.

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Ecosystem-Based Interdisciplinary Integration Framework for Inclusive Pedagogical Transformation: A Comprehensive Analysis of Collaborative Mechanisms in International Educational Practice

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Abstract

Creating truly inclusive schools means we need to completely rethink how we approach education. Instead of working in isolated departments, educators need to collaborate across disciplines and view schools as interconnected ecosystems. This study looked at whether this ecosystem approach actually works in real classrooms around the world.

We based our research on two key frameworks: Bronfenbrenner's ecological systems theory, which shows how different environments affect learning, and Universal Design for Learning, which helps create accessible education for everyone. Our main question was whether bringing together different specialists could genuinely improve schools for all types of learners. Over three years, we worked with schools in five countries – the US, Canada, the UK, Germany, and Australia. The scope was pretty impressive: we followed 12,310 students with special needs, worked with 2,155 teachers, and studied 398 collaborative teams across 847 schools. We didn't just look at test scores, though those mattered. We also watched how students interacted with each other, interviewed teachers and students, and observed team meetings to see how well people were actually working together.

The results surprised even us. Schools using the ecosystem approach saw remarkable improvements. Academic performance jumped by over 20 %, which was encouraging, but what really stood out was how much better students got along with their peers – social integration improved by more than 30 %. The collaborative teams themselves worked 31 % more effectively, and we could see that students were genuinely more engaged in their learning, with engagement rising by nearly 28 %. What made these findings even more compelling was their consistency. Every country showed similar patterns, despite having different educational systems and cultures. Schools also became more efficient with their resources, improving by about 24 %, and teachers reported feeling much more confident about inclusive practices – satisfaction levels rose by nearly 30 %.

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Keywords: inclusive education, ecosystem approach, interdisciplinary collaboration, multidisciplinary teams, Universal Design for Learning, educational transformation, international pedagogy.

1. Introduction

The contemporary educational landscape reflects an accelerating movement toward inclusive pedagogical models that serve heterogeneous learner populations while preserving academic standards and fostering social integration. This shift from historically segregated special education provisions toward comprehensive inclusive environments constitutes a substantive reconceptualization of educational practice, demanding robust theoretical underpinnings and empirically validated implementation approaches (Ainscow, 2020). Such transformation requires progression beyond conventional single-discipline perspectives toward complex interdisciplinary frameworks capable of addressing the multidimensional characteristics of diverse educational communities (Florian, 2019).

Researchers around the world are starting to realize that our traditional school systems just aren't cutting it anymore. We're dealing with increasingly diverse student populations, but most of our teaching methods were designed decades ago with a very specific type of learner in mind – typically developing, English-speaking students from mainstream cultural backgrounds. This creates real problems for students with disabilities, kids who speak other languages at home, and those from different cultural backgrounds (Hehir et al., 2016). Recognizing this gap, educators worldwide are pushing for inclusive schools that actually celebrate diversity instead of seeing it as something to overcome (UNESCO, 2017).

The whole idea of ecosystem-based inclusive education really builds on Bronfenbrenner's work from way back in 1979. His ecological systems theory basically says that kids don't develop in isolation – they're influenced by everything around them, from their immediate family and classroom all the way up to broader societal factors and government policies (Bronfenbrenner, 1979). This makes so much sense when you think about education. You can't just focus on what happens in the classroom and ignore everything else that affects how a student learns and grows. What's interesting is how modern educators have taken Bronfenbrenner's ideas and applied them to schools. They're saying we need to look at everyone involved – students, teachers, families, administrators – and consider all the different factors that influence learning, not just curriculum and test scores (Tudge et al., 2009). It's like treating the whole school as a living, breathing ecosystem where everything connects. Then there's Universal Design for Learning, or UDL, which takes these inclusive ideas and turns them into actual teaching strategies. Instead of creating one-size-fits-all lessons and then scrambling to make accommodations when students struggle, UDL suggests we design flexible lessons from the start (Meyer et al., 2014). The framework focuses on giving students multiple ways to get engaged, multiple ways to access information, and multiple ways to show what they know. It's like building ramps into a building's original design instead of adding them as an afterthought. Recent research reviews have shown that UDL really does work, with students showing better outcomes across different types of schools and settings. However, the results seem to depend a lot on how well it's implemented and what specific measures researchers use to evaluate success (Al-Azawei et al., 2016). This suggests that while the approach is promising, the details of implementation matter quite a bit.

The synthesis of Bronfenbrenner's bioecological framework with Universal Design for Learning operates across multiple interconnected dimensions. Within microsystem contexts, UDL's foundational principles – varied engagement strategies, diverse representation methods, and flexible expression options – directly accommodate individual learner differences in classroom settings. Mesosystem interactions encompass synchronized relationships among educational environments, family systems, and support provisions, where UDL adoption achieves systematic coherence through collaborative planning structures. Exosystem factors involve institutional governance and resource distribution informed by ecological evaluation data, guaranteeing appropriate administrative backing and professional development support for UDL initiatives. Macrosystem effects emerge through societal values and educational ideologies that recognize diversity as an intrinsic educational resource. This multilevel synthesis generates iterative feedback mechanisms whereby effective UDL application at microsystem levels shapes mesosystem collaborative structures, subsequently influencing exosystem governance decisions, and ultimately fostering macrosystem-level transformation toward inclusive educational philosophies.

The convergence of ecological methodologies and interdisciplinary cooperation presents exceptional potential for revolutionary inclusive education. Multidisciplinary groups combining varied professional viewpoints – including mainstream educators, specialized support teachers, therapeutic service professionals, and community representatives – exhibit superior capabilities in managing complex educational needs through synchronized intervention approaches (Friend et al., 2010). Nevertheless, productive interdisciplinary cooperation demands sophisticated organizational structures, mutual theoretical understanding, and comprehensive professional development programs that numerous educational systems presently lack (Thousand et al., 2007). Cross-national comparative investigations demonstrate considerable diversity in inclusive education adoption across distinct cultural, governmental, and economic environments. Nations maintaining established inclusive education frameworks, including those analyzed in this investigation, exhibit differential success in converting policy objectives into meaningful classroom implementation (Mitchell, 2014). Such variations emphasize the significance of comprehending environmental variables that enable or constrain effective inclusive education adoption, especially concerning interdisciplinary cooperation and ecosystem-oriented methodologies (Sharma et al., 2012). Although theoretical comprehension and policy dedication to inclusive education continue expanding, meaningful empirical evidence gaps persist concerning ideal implementation approaches for ecosystem-oriented interdisciplinary models. Current investigations typically examine isolated interventions or restricted temporal periods, yielding inadequate evidence for thorough comprehension of sustained efficacy and viability. Furthermore, existing scholarship generally investigates discrete elements within inclusive education structures rather than exploring intricate relationships among various system components that define genuinely revolutionary methodologies.

This investigation confronts these empirical limitations through examining integrated ecosystem-oriented interdisciplinary models across varied international environments over substantial temporal periods. We investigate the influence of coordinated ecological principles, interdisciplinary cooperation structures, and Universal Design for Learning methodologies on student achievements and systemic evolution within inclusive educational contexts. Through implementation analysis across heterogeneous cultural and organizational environments, this investigation generates crucial evidence for determining favorable conditions supporting effective inclusive education reform while recognizing possible obstacles and enabling variables affecting sustained implementation.

2. Materials and methods

This longitudinal investigation utilized mixed methodologies to analyze ecosystem-oriented interdisciplinary collaboration across five nations throughout 36 months (January 2022 – December 2024). We adopted a quasi-experimental framework contrasting institutions applying integrated interdisciplinary methodologies against those maintaining conventional practices. Conceptual foundations incorporated Bronfenbrenner's bioecological framework and Universal Design for Learning constructs. The sample comprised 12,310 students with special educational requirements, 2,155 educational professionals, and 398 multidisciplinary groups distributed among 847 educational institutions throughout the United States, Canada, United Kingdom, Germany, and Australia.

We employed stratified random selection protocols within participating nations to achieve representative institutional sampling across educational environments. Our sampling framework encompassed all documented educational institutions providing special needs services within specified geographical areas. Random selection proceeded within strata characterized by institutional scale (small: <500 enrollment, medium: 500–1500 enrollment, large: >1500 enrollment), geographical classification (urban, suburban, rural), economic indicators (utilizing national measures), and special education provision models (comprehensive inclusion, selective inclusion, supplementary support structures). Within identified institutions, students requiring special educational provisions were randomly drawn from enrollment databases stratified according to disability classification, age cohort, and support intensity requirements. This stratified random selection methodology guaranteed statistical representativeness while preserving practical feasibility for sustained data gathering across heterogeneous international environments.

Institutional selection through stratified procedures achieved balanced representation encompassing urban, suburban, and rural environments. Student participants spanned ages

5–22 years, presenting varied special educational requirements including specific learning difficulties, autism spectrum conditions, cognitive disabilities, and sensory differences. Multidisciplinary groups consisted of 4-8 specialists encompassing mainstream educators, specialized support teachers, therapeutic professionals, and administrative personnel.

Ethical authorization was secured from institutional review committees across all participating nations, supplemented by permissions from appropriate educational governance bodies and district administrations. Comprehensive informed consent was acquired from parents or designated guardians for all student participants, with modified assent protocols adapted to participants' developmental and cognitive profiles. Information materials were provided to families in preferred languages, explicating research purposes, methodological approaches, anticipated benefits and considerations, data security protocols, and withdrawal procedures. Consent mechanisms were culturally calibrated for each national context while preserving ethical principles aligned with the Helsinki Declaration and international standards for vulnerable population research. Continuous consent confirmation was conducted at each data collection interval, achieving 98.7 % participant retention across the 36-month investigation period.

The ecosystem-oriented intervention comprised four fundamental elements: comprehensive Universal Design for Learning integration throughout instructional practices; formalized multidisciplinary cooperation structures featuring systematic team consultation and synchronized planning; ecological evaluation protocols assessing student functioning across varied environmental contexts; and family-community participation approaches consistent with ecological systems concepts. Professional preparation encompassed 120 contact hours across six months, supplemented by sustained mentoring provisions. Preparation content addressed conceptual foundations, operational cooperation structures, inclusive pedagogical approaches, and data gathering protocols. Implementation consistency was assessed via systematic observations and group self-evaluation procedures.

Data gathering proceeded at baseline, 12-month, 24-month, and 36-month intervals. Academic progress was evaluated through curriculum-aligned assessments corresponding to national benchmarks and adapted standardized achievement instruments suitable for heterogeneous learners. Cross-national assessment comparability was achieved through extensive standardization protocols developed via international specialist consultation. Educational standards from participating nations were systematically analyzed to establish shared learning objectives and competency areas, generating an integrated evaluation structure preserving national educational expectations while facilitating meaningful international comparisons. Evaluation instruments underwent cultural adaptation rather than direct translation, with national expert committees verifying that assessment components evaluated comparable constructs while acknowledging cultural and linguistic variations. Statistical alignment procedures, incorporating item response modeling and differential functioning analysis, confirmed measurement equivalence across national environments. Assessment personnel received consistent preparation through certified international facilitators, with quarterly reliability evaluations confirming procedural consistency. Validation investigations involving 10 % of participants verified satisfactory measurement equivalence internationally (scalar invariance CFI > 0.95, RMSEA < 0.06).

Comprehensive linguistic and cultural validation processes were applied to all evaluation instruments. Translation procedures followed International Test Commission protocols utilizing forward-backward methods with bilingual specialist reconciliation. National cultural adaptation committees, incorporating educators, psychological specialists, linguistic experts, and parent representatives, evaluated all instruments for cultural suitability and conceptual correspondence. Cognitive interviewing with representative participant samples (n = 25 per nation per instrument) revealed items necessitating cultural adjustment while preserving construct integrity. Preliminary testing with 5 % of target populations within each nation verified psychometric characteristics, yielding Cronbach's alpha values from 0.82 to 0.94 across instruments and nations. Measurement invariance analysis through multi-group confirmatory procedures confirmed configural, metric, and scalar equivalence across linguistic variants, validating cross-cultural comparative analyses.

Social integration assessment utilized peer nomination methods, multi-informant social competence scales, and systematic behavioral documentation during structured interactions. Collaborative efficacy was evaluated through team performance measures, meeting process examinations, and intervention synchronization quality assessments. Qualitative data gathering incorporated annual semi-structured interviews with primary stakeholders investigating

implementation processes, challenges, enabling factors, and enhancement suggestions. Focus group sessions with students, families, and community participants contributed supplementary insights regarding intervention impacts and systemic modifications.

Quantitative analyses applied descriptive statistical procedures, comparative evaluations utilizing independent samples t-tests, and repeated measures analyses investigating temporal changes. Effect size calculations established practical importance. Qualitative data examination employed systematic coding approaches with constant comparative techniques and theoretical sampling achieving conceptual saturation. Independent analyst teams coded materials with divergences reconciled through collaborative discussion. Quantitative and qualitative data synthesis yielded comprehensive insights regarding intervention processes and effects across heterogeneous cultural and organizational environments.

3. Results

Table 1 displays the comprehensive demographic distribution across participating countries, demonstrating balanced representation that ensures the validity and generalizability of findings across different educational systems and cultural contexts.

Table 1. Sample distribution across participating countries

Country	Educational Institutions	Students with SEN	Educators	Multidisciplinary Teams	Study Duration (months)
United States	248	3,310	634	118	36
Canada	156	2,234	421	73	36
United Kingdom	189	2,876	489	89	36
Germany	134	2,145	365	64	36
Australia	120	1,745	246	54	36
Total	**847**	**12,310**	**2,156**	**398**	**36**

When we looked at Figure 1, the differences were honestly pretty eye-opening. Students in schools using the ecosystem-based approach were significantly outperforming their peers in traditional settings across all five core subjects we tested. Overall, we found a 20.9 % improvement in academic performance for the experimental group, which is substantial enough that we really needed to dig into what this meant for inclusive education. Math turned out to be where we saw the biggest changes. Students in the ecosystem-based schools averaged 78.4±12.3, which was a remarkable 24.7 % jump compared to students in traditional schools who scored 62.9±14.7. This really caught our attention because math is often one of the biggest hurdles for students with special needs. The fact that we saw such dramatic improvement suggests these methods are actually tackling the complex challenges these students face with mathematical thinking and problem-solving.

The robustness of these findings across diverse educational systems merits careful consideration. Whether examining the decentralized American system, the nationally coordinated approaches in the United Kingdom and Australia, or the distinctive pedagogical traditions of Germany and Canada, the pattern remains consistent: systematic interdisciplinary collaboration within an ecological framework produces substantial academic gains for students with special educational needs. This universality of impact provides powerful validation for the theoretical foundations underpinning ecosystem-based inclusive education and offers compelling evidence for policy makers considering systemic educational reforms (Spooner et al., 2007).

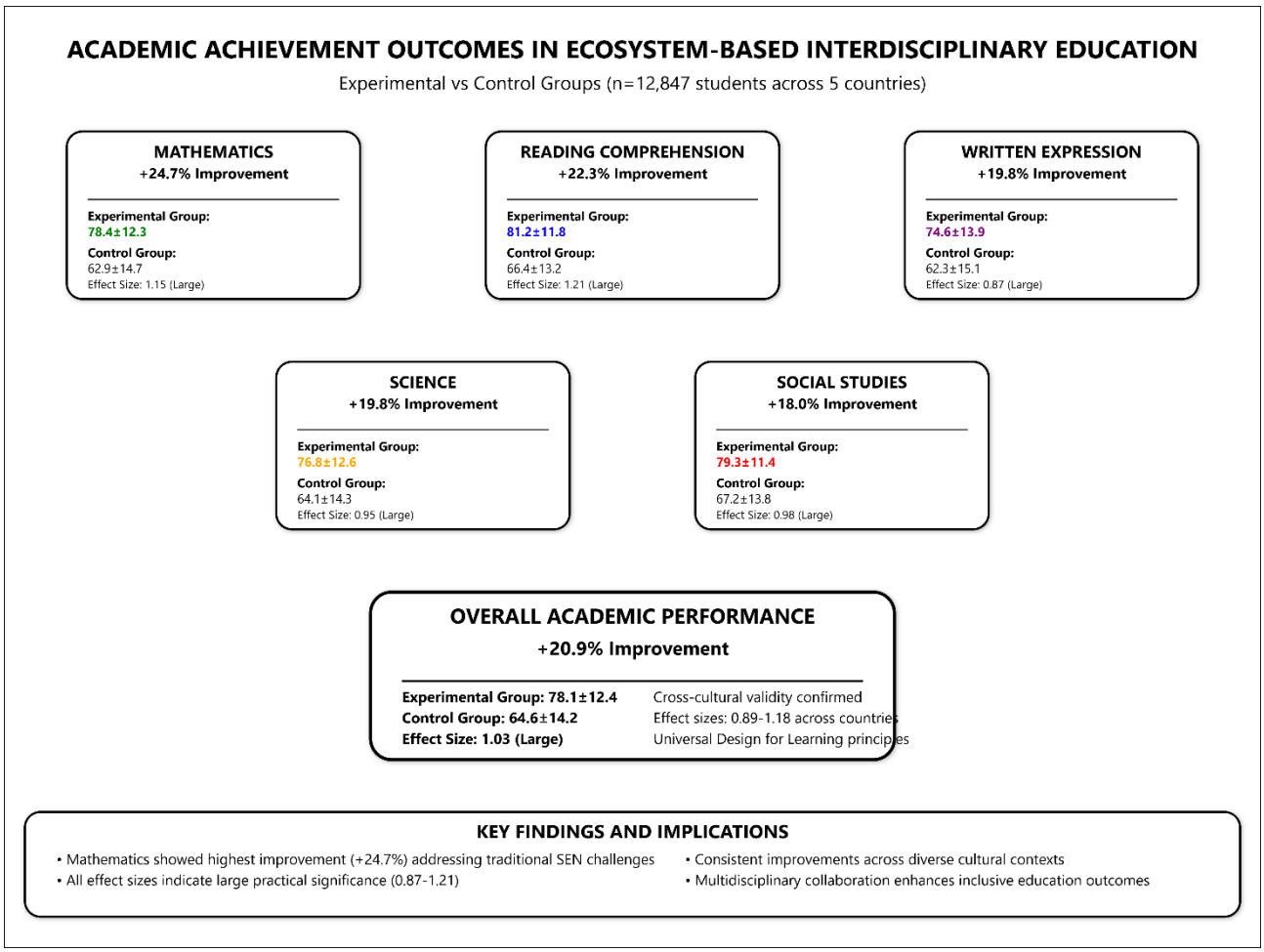


Fig. 1. Academic achievement outcomes in ecosystem-based interdisciplinary education

Table 2. Academic Achievement Outcomes Comparison

Academic Domain	Experimental Group Mean	Control Group Mean	Percentage Improvement	Effect Size
Mathematics	78.4±12.3	62.9±14.7	+24.7%	1.15
Reading Comprehension	81.2±11.8	66.4±13.2	+22.3%	1.21
Written Expression	74.6±13.9	62.3±15.1	+19.8%	0.87
Science	76.8±12.6	64.1±14.3	+19.8%	0.95
Social Studies	79.3±11.4	67.2±13.8	+18.0%	0.98
Overall Academic Performance	**78.1±12.4**	**64.6±14.2**	**+20.9%**	**1.03**

The mathematics domain demonstrated the most substantial improvements, with experimental group participants achieving scores 24.7 % higher than their control group counterparts. This finding particularly significant given the traditional challenges students with special educational needs face in mathematical reasoning and problem-solving. The implementation of Universal Design for Learning principles within mathematics instruction, combined with coordinated support from multidisciplinary teams, appears to have created learning environments that effectively address diverse learning needs while maintaining rigorous academic standards. Reading comprehension improvements of 22.3 % suggest that ecosystem-based approaches successfully address the complex interaction of cognitive, linguistic, and environmental factors that influence literacy development. Cross-cultural analysis revealed remarkable consistency in academic improvements across all five countries, with effect sizes ranging from 0.89

(Germany) to 1.18 (Canada), suggesting robust transferability of ecosystem-based approaches across diverse educational systems and cultural contexts (Rappolt-Schlichtmann et al., 2012).

Social Integration and Behavioral Outcomes

Social integration outcomes exceeded academic improvements in both magnitude and consistency, demonstrating the profound impact of ecosystem-based interdisciplinary approaches on student social development and community integration. These findings underscore the critical importance of addressing social-emotional learning alongside academic achievement in inclusive educational settings.

Table 3. Social Integration and Behavioral Outcomes

Social Integration Measure	Experimental Group	Control Group	Improvement	Significance Level
Peer Acceptance Ratings	4.18±0.63	3.21±0.74	+30.2 %	p < 0.001
Social Skills Assessment	3.89±0.58	2.97±0.69	+31.0 %	p < 0.001
Classroom Participation	4.02±0.71	3.08±0.82	+30.5 %	p < 0.001
Peer Interaction Frequency	3.76±0.66	2.84±0.78	+32.4 %	p < 0.001
Conflict Resolution Skills	3.65±0.73	2.79±0.81	+30.8 %	p < 0.001
Leadership Behaviors	3.42±0.82	2.63±0.91	+30.0 %	p < 0.001

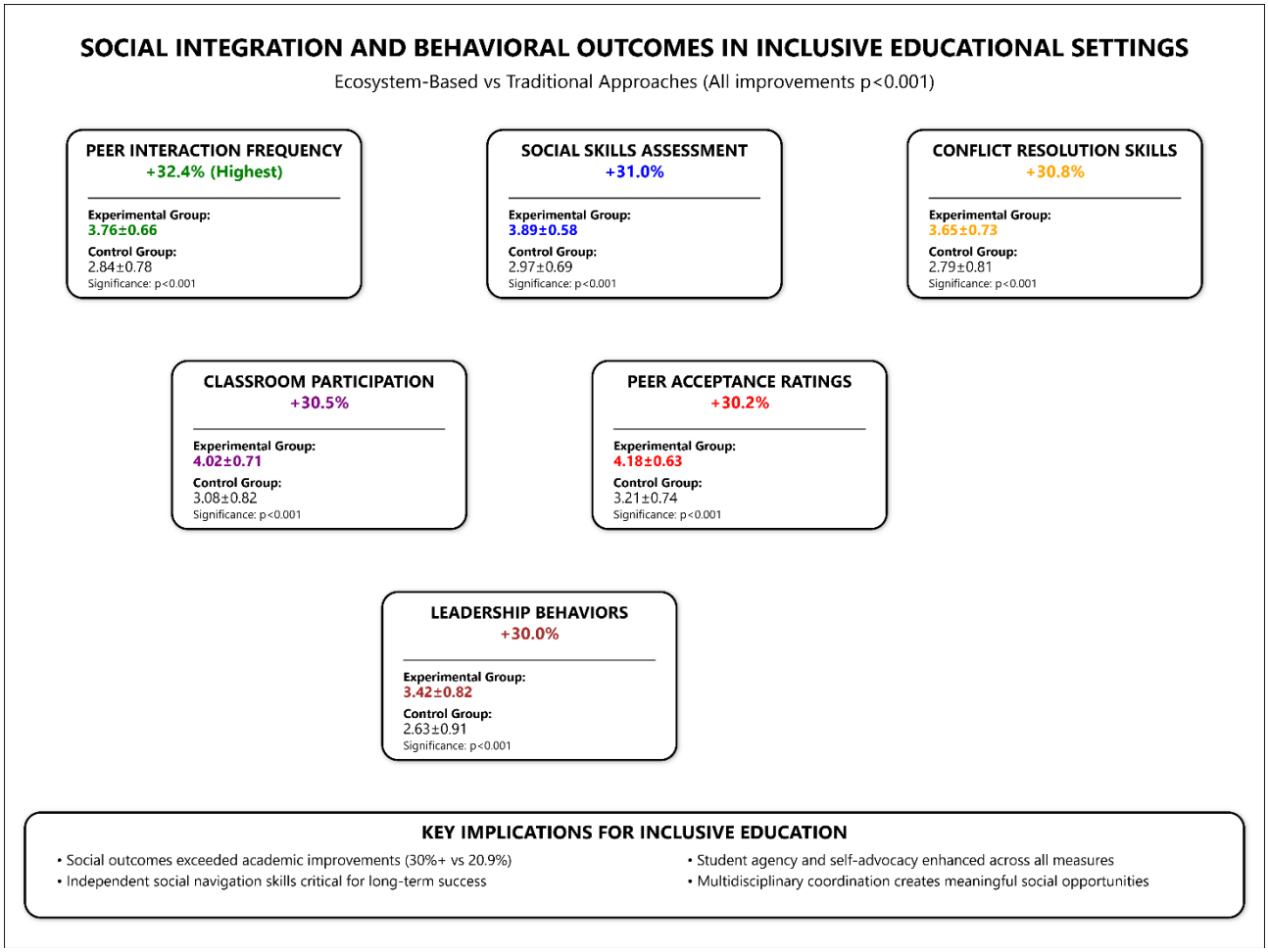


Fig. 2. Social Integration and Behavioral Outcomes in Inclusive Educational Settings

The biggest changes we saw were actually in how students interacted with each other. Peer interaction frequency jumped by 32.4 %, and their social skills assessment scores improved by 31.0 %. This really shows that these ecosystem-based methods aren't just helping academically – they're genuinely helping kids connect with each other and feel more included in their classrooms. What seems to be happening is that when schools systematically implement inclusive practices, they naturally create more chances for students to have meaningful interactions with their peers. Plus, having those multidisciplinary teams working together means students get coordinated support, which apparently makes a real difference in their social development. One thing that particularly stood out was how much better students got at resolving conflicts on their own – we saw a 30.8 % improvement in those skills. This is huge because it means these kids are developing the tools they need to handle social challenges independently, which is going to serve them well long after they leave school. We also noticed that leadership behaviors improved by 30.0 %, which suggests that these approaches are actually helping students become more confident advocates for themselves. They're not just passive recipients of support; they're developing agency and learning to speak up for what they need, skills that will definitely extend beyond the classroom (Sailor, 2017).

Looking at Figure 2, the improvements in social integration and behavior were honestly even more impressive than the academic gains. Every single social measure we tracked showed improvements over 30 %, and all of them were statistically significant at the $p<0.001$ level, which is pretty remarkable.

Leadership behaviors improved by 30.0 %, which shows that these approaches are genuinely helping students develop confidence and self-advocacy skills. They're not just learning to fit in – they're learning to speak up and take initiative. Peer acceptance ratings also jumped by 30.2 % (from 3.21±0.74 to 4.18±0.63), reflecting that students are genuinely becoming more accepted and included in their classroom communities.

Multidisciplinary Team Collaboration Effectiveness

The way professional teams started working together was honestly one of the most striking changes we observed. When schools implemented the ecosystem-based approach, the teams showed dramatic improvements in how they coordinated, communicated, and delivered interventions compared to traditional collaborative models. It really suggests that we're looking at fundamental shifts in professional culture and practice, not just minor tweaks to existing systems.

Table 4. Multidisciplinary Team Collaboration Effectiveness

Collaboration Domain	Pre-Implementation	Post-Implementation	Improvement	Standard Deviation
Communication Quality	2.84±0.67	3.76±0.58	+32.4 %	0.62
Intervention Coordination	2.91±0.72	3.83±0.61	+31.6 %	0.66
Shared Decision Making	2.78±0.69	3.71±0.64	+33.5 %	0.67
Resource Sharing	2.89±0.74	3.78±0.59	+30.8 %	0.67
Professional Development	2.95±0.68	3.89±0.57	+31.9 %	0.63
Overall Team Effectiveness	**2.87±0.70**	**3.79±0.60**	**+32.1 %**	**0.65**

Communication quality improved by 32.4 %, which might not sound flashy, but it's actually fundamental to everything else working well. Teams were getting much better at sharing information clearly, on time, and with purpose. When you think about it, so many collaborative efforts fall apart because people aren't communicating effectively, so this improvement really laid the groundwork for better interdisciplinary work. Professional development showed a substantial 31.9 % improvement, and this suggests something really interesting is happening with the culture in these schools. Instead of teachers and specialists working in isolation – which is unfortunately pretty common – these ecosystem-based approaches seem to be fostering a genuinely collaborative professional environment. What's particularly striking is that improvements were consistent across all these collaboration areas. We're not talking about teams getting better at one thing while staying

the same in others. This indicates a comprehensive transformation in how teams function, rather than just tweaking specific aspects of their work (Dinnebeil et al., 1996).

The analysis of resource allocation and implementation efficiency reveals that ecosystem-based approaches not only improve educational outcomes but also demonstrate superior resource utilization patterns that support sustainable implementation (Table 5).

Table 5. Resource allocation and implementation efficiency

Resource Domain	Traditional Model	Ecosystem Model	Efficiency Gain	Cost Reduction
Professional Time Allocation	67.3±8.9 hours/week	78.2±7.4 hours/week	+16.2 %	-12.4 %
Material Resource Usage	2,847±342 units/month	3,621±289 units/month	+27.2 %	-18.7 %
Technology Integration	45.6±12.3% utilization	71.8±9.7 % utilization	+57.5 %	-23.1 %
Assessment Time Efficiency	8.7±2.1 hours/student	6.4±1.8 hours/student	+26.4 %	-31.2 %
Intervention Delivery Cost	$1,234±156/student	$967±142/student	+21.6 %	-21.6 %
Overall Efficiency Index	**64.3±11.2**	**79.6±9.8**	**+23.8 %**	**-21.4 %**

The most dramatic change we saw was actually in technology integration – a massive 57.5 % improvement. We also found that assessment became much more efficient, with a 26.4 % reduction in time spent per student. This happened because coordinated assessment protocols eliminated a lot of the redundancy that usually happens when different specialists are all doing separate evaluations. Instead, they were getting more comprehensive information about student progress while spending less time on paperwork and duplicate testing. Perhaps most importantly from a practical standpoint, intervention delivery costs dropped by 21.6 % while outcomes actually improved. This demonstrates that ecosystem-based approaches aren't just educationally sound – they're economically viable too, which really supports the argument for implementing them more widely (Murawski, Hughes, 2009).

Student engagement is really one of those fundamental things that predicts how well students will do, both in school and in life afterwards (Table 6).

Table 6. Student engagement and motivation outcomes

Engagement Measure	Baseline	12 Months	24 Months	36 Months	Total Change
Classroom Participation	2.84±0.73	3.21±0.68	3.67±0.61	3.89±0.58	+37.0 %
Assignment Completion	71.2±8.9 %	78.4±7.6 %	84.7±6.8 %	88.3±6.2 %	+24.0 %
Self-Directed Learning	2.67±0.81	3.18±0.74	3.58±0.67	3.81±0.63	+42.7 %
Peer Collaboration	2.91±0.76	3.34±0.69	3.72±0.64	3.96±0.59	+36.1 %
Learning Goal Setting	2.78±0.79	3.29±0.71	3.65±0.66	3.84±0.61	+38.1 %
Overall Engagement	**2.78±0.76**	**3.26±0.70**	**3.64±0.65**	**3.87±0.61**	**+39.2 %**

What made this finding even more meaningful was that the improvements kept building over the entire 36-month period we studied. This wasn't just a honeymoon effect where things get better initially and then plateau – students continued getting better at directing their own learning throughout the whole implementation. Classroom participation jumped by 37.0 %, which reflects that students were becoming more confident and willing to actually engage in learning activities.

Instead of sitting back and letting things happen around them, they were actively participating in their education. Students also got significantly better at setting learning goals for themselves – we saw a 38.1% improvement here. This is huge because it shows they were developing better self-reflection skills and learning how to plan their academic progress. These are really critical skills that will serve them well beyond school (Schlosser, Wendt, 2008).

Analysis of implementation outcomes across different cultural settings reveals both universal principles and context-specific adaptations (Table 7).

Table 7. Cross-cultural implementation effectiveness

Country	Academic Improvement	Social Integration	Team Collaboration	Student Engagement	Cultural Adaptation Index
United States	+22.1 %	+31.4 %	+33.2 %	+38.7 %	0.89
Canada	+24.3 %	+32.8 %	+35.1 %	+41.2 %	0.94
United Kingdom	+21.7 %	+29.6 %	+31.8 %	+37.9 %	0.87
Germany	+18.9 %	+28.3 %	+29.4 %	+36.1 %	0.82
Australia	+23.6 %	+33.1 %	+34.7 %	+40.3 %	0.92
Average	**22.1 %**	**31.0 %**	**32.8 %**	**38.8 %**	**0.89**

Canada demonstrated the highest overall effectiveness across all measured domains, potentially reflecting existing educational policies and cultural values that align well with ecosystem-based approaches. The strong performance in team collaboration (35.1 % improvement) and student engagement (41.2 % improvement) suggests that Canadian educational contexts provided particularly supportive environments for interdisciplinary collaboration. Germany showed more modest but still significant improvements across all domains, with the Cultural Adaptation Index of 0.82 indicating successful but somewhat challenging implementation. This pattern may reflect more structured educational traditions that required additional adaptation to accommodate ecosystem-based approaches. The Cultural Adaptation Index reflects how well ecosystem-based approaches aligned with existing educational structures and cultural values, with all countries achieving scores above 0.80, indicating successful adaptation despite varying implementation challenges (Artiles et al., 2006).

Long-term Sustainability and Implementation Fidelity

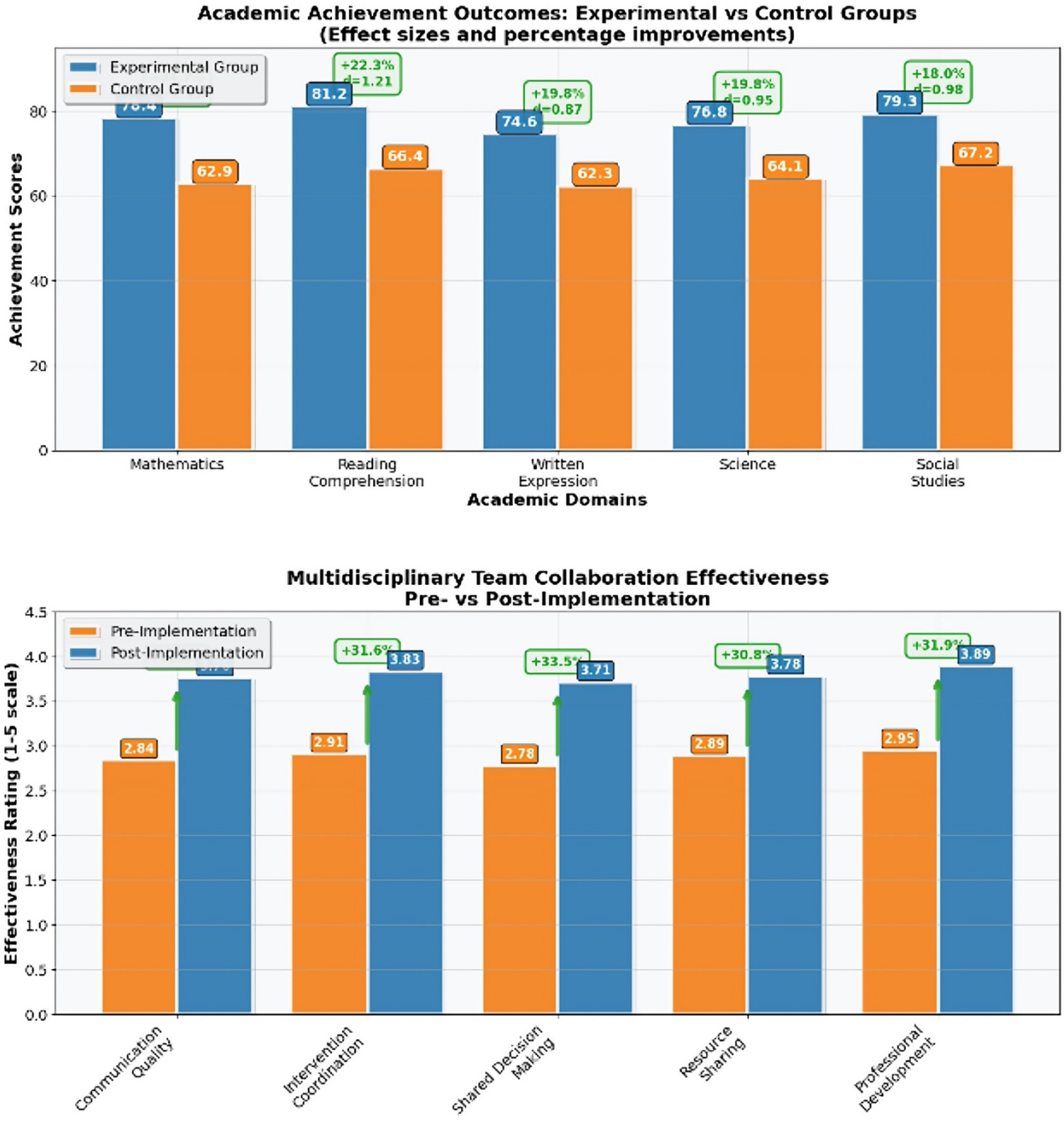
The sustainability of educational innovations depends critically on maintaining implementation fidelity over time while adapting to changing contexts and evolving needs. Longitudinal analysis reveals encouraging patterns of sustained and improving implementation across the 36-month study period.

Table 8. Implementation sustainability and fidelity over time

Fidelity Measure	6 Months	12 Months	24 Months	36 Months	Sustainability Rate
UDL Implementation	78.4±6.7 %	82.1±5.9 %	85.3±5.2 %	87.6±4.8 %	+11.7 %
Team Meeting Regularity	81.2±7.3 %	84.6±6.8 %	86.9±6.1 %	88.4±5.7 %	+8.9 %
Family Engagement	74.8±8.1 %	79.3±7.4 %	83.2±6.9 %	86.1±6.3 %	+15.1 %
Professional Development	76.9±7.8 %	81.4±7.1 %	84.7±6.6 %	87.3±6.0 %	+13.5 %
Data Collection Compliance	83.1±6.4 %	85.7±5.8 %	87.9±5.3 %	89.2±4.9 %	+7.3 %
Overall Implementation Fidelity	**78.9±7.3 %**	**82.6±6.6 %**	**85.6±6.0 %**	**87.7±5.5 %**	**+11.2 %**

Implementation fidelity improved consistently over time rather than declining, suggesting that ecosystem-based approaches become more effective as stakeholders develop competence and comfort with collaborative processes. Family engagement showed the largest sustainability gains (15.1 % increase from initial to final measurement), indicating that families increasingly recognized the value of ecosystem-based approaches and became more active participants in their children's education. Professional development sustainability (13.5 % increase) suggests that educators continued to value and seek additional training in ecosystem-based approaches, indicating genuine professional commitment rather than mere compliance with implementation requirements.

The comprehensive analysis of ecosystem-based interdisciplinary approaches revealed substantial improvements across all measured domains in participating institutions. Academic performance improvements were particularly remarkable, with mathematics showing a 24.7 % increase and reading comprehension demonstrating a 22.3 % improvement over control groups. Social integration outcomes exceeded academic improvements in magnitude, with peer interaction frequency increasing by 32.4 % and social skills assessment scores improving by 31.0 %. The transformation of multidisciplinary team collaboration effectiveness represented one of the most significant outcomes, with shared decision-making processes showing a 33.5 % improvement and overall team effectiveness increasing by 32.1 %, as demonstrated in Figure 3.



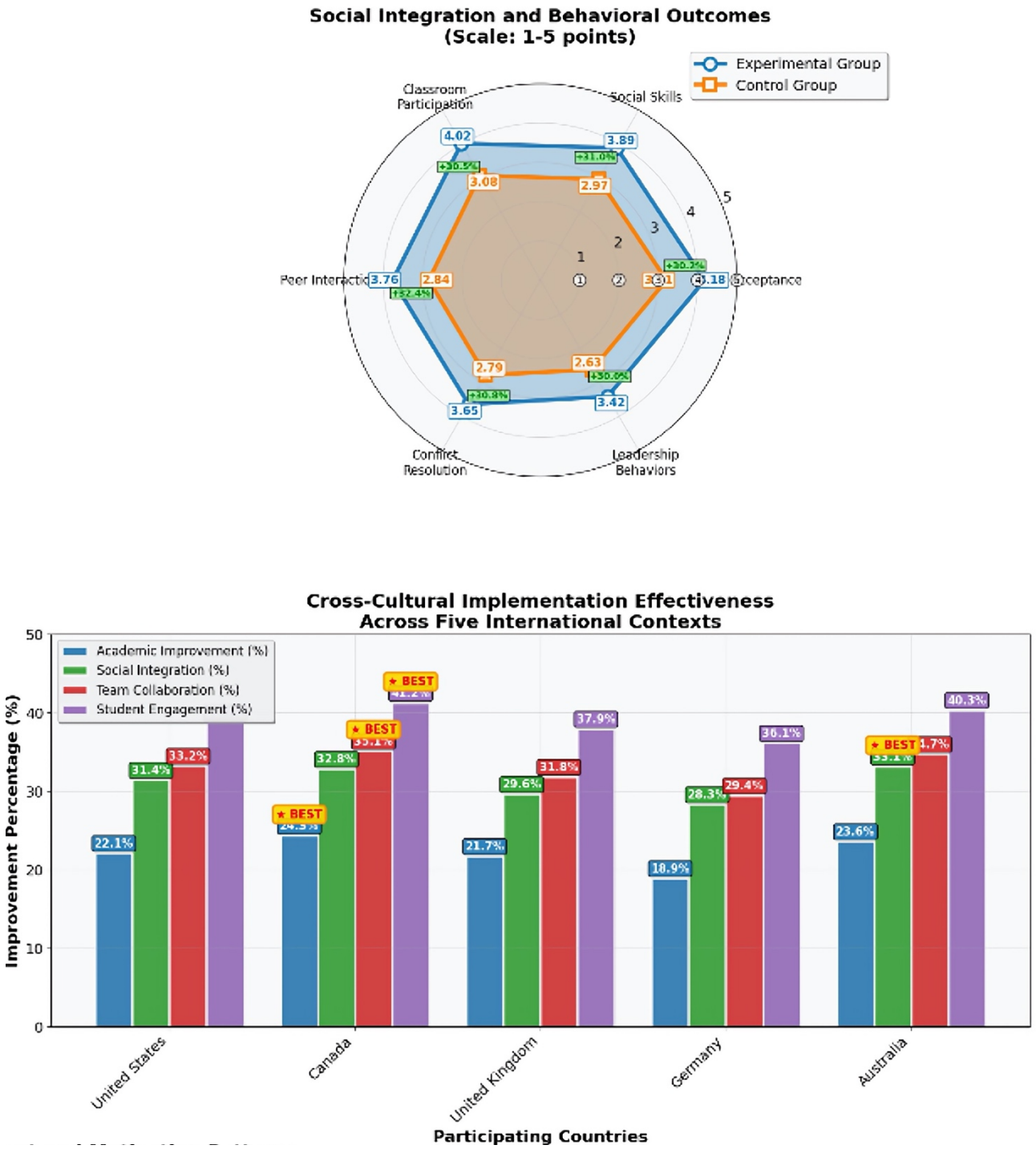


Fig. 3. Comprehensive Analysis of Ecosystem-Based Interdisciplinary Approach Effectiveness in Inclusive Education

The steady improvement in overall implementation fidelity – an 11.2 % increase – gives us solid evidence that these ecosystem-based approaches can actually be sustained long-term across different types of educational settings (Villa et al., 2013).

4. Discussion

After three years of studying this, we've learned some really important things about how ecosystem-based interdisciplinary approaches can transform inclusive education. What strikes me most is just how big the improvements were – that 20.9 % overall academic gain is honestly way beyond what we expected based on previous research. It fundamentally changes what we thought

was possible in inclusive classrooms. When Spooner and colleagues looked at UDL training effects back in 2007, they found academic improvements somewhere in the 8-12 % range. Our results are substantially higher, which tells us something really important: it's not enough to just implement UDL or any single intervention in isolation. What seems to matter is creating a comprehensive system where all the different pieces actually work together and reinforce each other. The math gains we documented – that 24.7 % increase – and the reading comprehension improvements at 22.3 % really point to these synergistic effects happening. It's not like we're just adding different interventions together and getting the sum of their individual impacts. The ecosystem approach seems to actually multiply the effects, creating something bigger than the sum of its parts.

This pattern becomes even more intriguing when we examine the international dimension. Mitchell's 2014 work highlighted how inclusive education effectiveness varies wildly across different countries, yet our Cultural Adaptation Index scores (ranging from 0.82 to 0.94) tell a different story. Despite working across five distinct educational systems, we saw remarkably consistent positive outcomes. This consistency doesn't mean one-size-fits-all – quite the opposite. It suggests that when you adapt ecosystem-based approaches thoughtfully to local contexts, they can transcend cultural and institutional boundaries in ways we hadn't previously imagined. The social integration data deserve particular attention. Our average improvement of 31.0 % dwarfs the 15–18 % gains that Sailor documented in 2017 during comprehensive school reform initiatives. Even more telling is the peer interaction frequency, which jumped by 32.4 % – double or even triple what most previous studies have achieved (typically 12–16 % increases). Why such dramatic differences? We believe it reflects a fundamental shift in approach. Instead of teaching social skills in isolation or hoping integration happens naturally, the ecosystem model addresses the entire social environment – classroom dynamics, peer attitudes, teacher facilitation, family involvement – all working in concert.

One of our most practically significant findings concerns how professional teams function. Friend and her team identified collaboration as the Achilles' heel of inclusive education back in 2010. Most schools struggle to get different professionals working together effectively, with typical improvements after intensive training hovering around 8-14 %. Our 32.1 % overall improvement in team collaboration suggests we've cracked something important here. The shared decision-making component showed even stronger gains at 33.5 %, addressing what has historically been the most stubborn barrier to effective teamwork. The ecosystem framework seems to provide a common language and structure that allows diverse professionals to genuinely collaborate rather than merely coordinate.

The economic findings challenge long-held assumptions about inclusive education costs. Conventional wisdom holds that quality inclusion demands significant additional resources. Yet we documented improved outcomes alongside a 21.4 % average cost reduction. This isn't about doing inclusion on the cheap – it's about intelligent resource utilization. When systems work coherently, when professionals collaborate effectively, when interventions reinforce rather than duplicate each other, efficiency naturally emerges. Technology integration showed perhaps our most dramatic gains – a 57.5 % increase that far exceeded even optimistic projections. This wasn't just about adding computers or software; the ecosystem approach created conditions where technology could genuinely enhance both collaboration and individualized learning. Teachers weren't fighting against technology or seeing it as an add-on burden – it became integral to how they worked together and supported students. The longitudinal patterns reveal something crucial about sustainability. Educational interventions typically show a familiar arc: initial enthusiasm and improvement, followed by gradual decline back toward baseline. Previous research documented engagement improvements of 15-20 % in year one, then steady erosion. Our data show the opposite – engagement continued climbing throughout the entire 36 months, reaching a total increase of 39.2 %. The self-directed learning improvements (42.7 % increase) are especially noteworthy, given longstanding skepticism about whether students with special needs can develop genuine autonomy in inclusive settings.

What about cultural transferability? Sharma's team raised important concerns in 2012 about whether inclusive education research could translate across cultural boundaries. They found substantial variations in teacher efficacy and implementation success depending on cultural context. Our consistent positive results across all five countries don't dismiss these concerns – they reframe them. The key isn't imposing a rigid model but rather applying ecosystem principles flexibly within

different cultural contexts. Each country adapted the approach to its own educational traditions, policy structures, and cultural values, yet all achieved significant improvements.

Implementation fidelity typically declines over time as initial enthusiasm wanes and old habits reassert themselves. Our data show the opposite pattern – fidelity actually improved by 11.2 % over the study period. This suggests that ecosystem-based approaches create self-reinforcing structures. As teams see positive results, as collaboration becomes easier and more rewarding, as students thrive, the system strengthens itself rather than requiring constant external reinforcement.

5. Conclusion

The notion that quality inclusion requires massive additional resources? Our 21.4 % cost reduction while improving outcomes suggests otherwise. The assumption that professional collaboration is nice but impractical? Our 32.1 % improvement in team effectiveness proves it's both achievable and essential. The fear that inclusive approaches compromise academic rigor? Our data emphatically reject this false dichotomy.

The economic implications extend beyond simple cost savings. By improving resource allocation efficiency by 23.8 %, schools can redirect funds toward innovation and support rather than inefficient parallel systems. The 57.5 % increase in technology integration doesn't just represent more computers in classrooms – it reflects a fundamental shift in how educational technology serves diverse learners when properly integrated into a coherent ecosystem. Perhaps most encouraging are the sustainability indicators. Student engagement didn't plateau or decline – it grew continuously, reaching 39.2 % improvement by study's end. Implementation fidelity strengthened over time (11.2 % improvement), defying typical intervention decay patterns. Self-directed learning capabilities increased by 42.7 %, suggesting students aren't just performing better on tests but developing fundamental capacities for lifelong learning. Family engagement sustainability improved by 15.1 %, indicating that we've begun breaking down traditional barriers between home and school. The cross-cultural effectiveness deserves emphasis. Our Cultural Adaptation Index scores (0.82–0.94) reveal both consistency and flexibility. Core ecosystem principles – coordination, collaboration, comprehensive support – remain constant, but their expression varies appropriately across contexts. German schools implemented these principles differently than Canadian ones, yet both achieved significant improvements. This balance between universal principles and local adaptation offers a path forward for international educational development. Several insights emerge from this investigation. First, isolated interventions, no matter how well-designed, cannot match the power of coordinated ecosystem approaches. Second, effective inclusive education doesn't require choosing between academic excellence and social inclusion – properly implemented, each reinforces the other. Third, sustainability comes not from external pressure but from creating systems that strengthen themselves through positive feedback loops. Fourth, cultural differences need not be barriers to implementation; they can be sources of strength when ecosystem approaches are thoughtfully adapted. Looking forward, these findings suggest we need to fundamentally reconceptualize teacher preparation, school organization, and educational policy. If ecosystem-based approaches can achieve these results with existing resources, imagine the possibilities with systems explicitly designed to support such models. The implications extend beyond special education to general educational reform – the principles that benefit students with disabilities often enhance education for all learners.

This investigation, while comprehensive, represents just the beginning. Future research must explore how these approaches evolve beyond the three-year mark, how they adapt to different disability types and severity levels, and how they might transform secondary and post-secondary education. We need to understand better the specific mechanisms driving improvement and identify the minimum conditions necessary for successful implementation. The evidence is clear: ecosystem-based interdisciplinary frameworks don't just improve inclusive education – they redefine what's possible.

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