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Research Article

Professional Competence of Secondary School Teachers and the Development of Students Practical Skills for PISA Readiness

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Abstract

The Programme for International Student Assessment (PISA) serves as a global benchmark for evaluating students' ability to apply knowledge in reading, mathematics, science, and problem-solving contexts. Teacher professional competence is widely recognized as a critical factor influencing students' preparedness for such assessments. This study investigates the relationship between teachers' professional competence and the development of practical classroom skills that support PISA-oriented learning outcomes. Professional competence is defined through formal qualifications, teaching experience, and participation in continuous professional development activities. A mixed-methods research design was employed using teacher profile data, structured classroom observations, and interview evidence collected from selected secondary schools. Key variables included teacher qualifications, years of experience, engagement in training programs, and practical teaching skill scores derived from observation protocols and self-assessment measures. Quantitative analyses involved descriptive statistics, Spearman's rank correlation to examine associations between professional indicators and practical skills, independent t-tests, and one-way ANOVA for group comparisons. Quantitative data were analysed using IBM SPSS, while qualitative data were coded and thematically analysed using NVivo to explore instructional practices, information and Communications Technology (ICT) integration, and classroom engagement strategies. Results reveal a significant positive relationship between teacher professional competence and practical teaching skills aligned with PISA requirements ($p < 0.001$). Teachers with higher qualifications, greater experience, and sustained professional training demonstrated stronger lesson organization, effective ICT use, increased classroom interaction, and greater implementation of STEM-oriented activities that promote critical thinking and problem solving. The findings highlight the importance of aligning teacher professional development with international assessment frameworks to enhance learning environments and improve students' readiness for global competency assessments.

Keywords: Program for International Student Assessment (PISA), Teaching, Learning Environment, Science, Technology, Engineering, Mathematics, ICT.

INTRODUCTION

One of the most significant international educational quality indicators is the Program

for International Student Assessment (PISA), arranged by the Organization for Economic Co-operation and Development (OECD) [1, 2]. It is held on a triannual basis and assesses how students in the 15th grade use their reading, mathematics, and science skills in the real-life environment [3]. Unlike the traditional tests that focus on memorization, PISA is based on critical thinking, analytical thinking, and solving problems as the competencies required in contemporary societies [4]. PISA results are widely used to compare educational outcomes across nations, identify strengths and weaknesses within school systems, and guide policymakers in reforming curricula, teacher training, and resource allocation [5]. PISA is a benchmark for schools and teachers to adapt their teaching to the learners' future challenges in higher education and the labor market competencies [6]. There are still many aspects, nevertheless, that create problems in the PISA student preparation process. The professional status of the teacher is among the primary concerns that include formal education and working years along with ongoing training [7]. Some of the issues that most education systems are grappling with include unfair distribution of training, low ICT integration and prioritization of Science, Technology, Engineering, and Mathematics (STEM) education [8]. The training of the teachers in the same areas is usually a contributor to the fact that the development of higher-order skills in the students is postponed. The benefits of teacher professional development being connected to the PISA preparation are high [9]. Teachers with advanced practical skills can design well-structured lessons, manage classrooms effectively, integrate ICT tools, and introduce STEM-oriented learning tasks that foster problem-solving and creativity [10]. These practices are not only effective in raising PISA outcomes but also the overall quality of education, so that a student is more prepared to handle lifelong learning. The necessity for top performance in global measurements may lead to widespread test teaching, pedagogical squeezing, and a general neglect of more complete learning experiences [11]. Besides, the practice of adapting teaching strategies to comply with global benchmarks, while at the same time disregarding local cultural and educational factors, may create frictions in the educational systems. In such a scenario, it is still very important to investigate the professional level of teachers and their role in the process of equipping students with the skills necessary for PISA [12].

However, despite the fact that the Albanian secondary education system encounters the threats of insufficient ICT adoption and unequal access to professional growth, comparative international research makes a crucial step in terms of assessing the current results. Authors in [12] found that teacher professional development has a significant impact on student achievement in PISA in several countries with high income in the OECD. This study can be characterized as a step further in the evolution of the state of art since, by systematically contrasting the profile of Albanian teachers and classroom practices with those abroad, the gaps in context-specific differences in STEM-oriented and ICT-supported instruction can be identified. This comparative place underlines the analytical rigor of the research and places its contribution in the context of the rest of the global literature on teacher effectiveness and preparedness to PISA [13-20].

The main contribution of this research work is as follows:

- Even though teacher professionalism, integration of ICT, and PISA-related competencies have become popular topics of research in OECD and high-income education [7, 21-26], there is a paucity in empirical evidence of classroom-based practices in the transitional and post-socialist settings. The present study is an original contribution since it is the first mixed-method, classroom-observational research involving teacher qualifications, experience, and professional training and how it can be converted into PISA-conforming instruction in Albanian secondary school.
- This study, in contrast to earlier large-scale research which has mainly used self-reported survey tools or other international datasets, incorporates structured classroom observations, practical skill rubrics that have been validated and teacher self-assessments as well as qualitative interviews to directly quantify observable instructional behaviors related to problem-solving, inquiry-based learning, and applied reasoning. This methodological triangulation contributes to the literature as it is an empirical demonstration of a connection between professional characteristics with observed classroom practices as opposed to perceived competence itself.
- Moreover, the study offers new context-specific information about the system of transitional education in Albania and Balkans. Unlike OECD settings where the institutionalized professional learning communities and systematized instructional coaching are established [26], teachers in Albania work within the framework of fragmented professional development, imbalanced ICT pedagogical capacity and lack of both systematic STEM instructional support, especially in the rural and semi-urb surroundings. The results indicate that the professional training produces a disproportionately higher impact on the ICT integration, as well as implementation of STEM tasks in Albania, compared to those described in the high-income systems, which means that teacher professional capital functions differently in the institutionally constrained environments.
- This study contributes to the international theory by locating Albania as part and parcel of wider Balkan and post-socialist patterns of educational reform similar to Serbia, Kosovo, and North Macedonia, in that systemic capacity, governance models, and access to professional development are the conditions that influence the efficacy of teacher professionalism to generate PISA-relevant teaching practices. These findings generate actionable, context-sensitive evidence for policy design in transitional education systems, thereby offering theoretical, methodological, and applied contributions beyond existing state-of-the-art research.
- This research provides the first empirical evidence from the Albanian secondary education system linking teacher professional qualifications, experience, and professional development participation to PISA-aligned instructional practices. While existing state-of-the-art studies have focused predominantly on high-income

OECD contexts [17, 27], this research extends the literature to a transitional education context, revealing distinctive gaps in ICT integration and STEM pedagogy implementation. By combining classroom observations, self-assessments, and interviews, the study delivers context-sensitive, actionable insights for teacher professional development policy in developing and post-transition education systems.

Additionally, a critical realist framework to investigate a group of medical students' views on programmatic assessment in a medical curriculum [13]. The patterns in feedback and learning experiences were found through semi-structured interviews and thematic coding. They stated that systematized instructions enhanced skill learning and involvement, but the one-university study reduced the external validity. Such a study highlights the significance of classroom-based observation in the assessment of the teaching practice, and similar approaches were also used in the present research on the teacher's professional level and practical skills to prepare for the PISA.

PISA examined as a politically determined global teaching tool that is impacting the national curriculum [14]. Conceptual and documentary analysis showed that there was conformity in standardized learning outcomes and PISA frameworks. But there was no evidence at a classroom level, crippling practical instructional insight. The study shows the necessity to connect policy models with teacher behaviors, which the current study covers by using direct observations and skill tests.

To explored international tests as infrastructures that define educational inequalities [15]. The analysis of history and socio-politics pointed to the presence of power relations and their effect on comparative standards. But to underline the fact that professional abilities of teachers have an intermediary role in student achievements, the present study will set its priorities on the development of practical skills according to PISA standards.

The determined scaling choices on international assessment scores through simulation psychometric modeling [16]. The difference in model assumptions influenced the interpretation of the scores by a maximum of 0.20 standard deviations. Although quite technical, the study proves the relevance of measurement accuracy, guiding the construction of rubrics and quantitative scoring tools in the present study to assess teacher practical skills.

In research by [17], the authors depended on multilevel regression to examine the importance of ICT integration to the learning outcomes in countries with varying development levels. The strongest positive associations were observed in high-income settings, whereas a cross-sectional design restricted making causal inferences. This observation concurs with the fact that ICT use has been incorporated as an applicable skill in the current research and with the aim of investigating the concept of teacher-led technology integration in classroom practice as a solution to PISA preparedness.

The hypothesis of the teacher-student relationship and adolescent school belonging among 62 countries through structural equation modeling [18]. Close relations were found between teacher connection and student engagement, but self-report data brought about

possible bias. The current study also focuses on teacher engagement and classroom management in the enhancement of practical and higher-order skills in students.

Surveys and interviews were used to identify quality indicators of the services in international student recruitment [19]. The satisfaction variance was found to be over 65 per cent, accounted for by academic support and teaching quality. The study points to the fact that the quality of institutions and teaching has a strong influence on the performance of learners, which prompts the evaluation of the teacher's level of qualification, experience, and training to promote PISA-oriented skills.

The international student satisfaction with foundation programs in three countries [20]. It was revealed through comparative survey analysis that there were improved performance outcomes with structured academic support and instructional integration, but these results were limited to national differences. These observations justify the focus of the current research on systematic classroom observation and systematic skill assessment to know how the teacher influences student readiness.

To compared the frequency of online activities and reading literacy, based on a 2000-2018 longitudinal dataset [21]. Online chatting was associated with worse reading. Even though behavioral information was secondary, the indications of the study reflect the fact that the learning environment and teaching instructions determine the development of the skills of students, supporting the significance of assessing teachers' practical skills in the process of developing PISA competencies.

The level of creative thinking skills in higher education was evaluated by evaluating the effectiveness of pre- and post-intervention designs [22]. Effect sizes that were greater than 0.60 were significant improvements due to specific pedagogical directions, but there was a lack of coverage in the discipline. This justifies the rationale of the incorporation of STEM-oriented and inquiry-based activities in assessment in the classroom to facilitate problem solving and critical thinking, which is the focus of the present study.

To explored inclusion discourses in international student assessment structures through critical policy and discourse analysis [23, 28]. The analysis showed systemic processes of exclusion with inclusive discourse. In the given study, this is the subject of discussion because the emphasis was put on teacher professional activities promoting active engagement with diverse students and the acquisition of PISA-related skills.

The aim of the research by [29] was to explore the impact of OECD on the equity policies of national education over the past thirty years. Policy reports and documents on OECD were analyzed qualitatively, following the change in equity focus and policy adoption. Results revealed greater stress on equity around the globe, but there was still disparity in the outcomes of education globally, and the constraints were that they depended on document analysis without gauging the outcomes directly.

Existing studies have established important associations between teacher professionalism, ICT integration, and student competencies using large-scale survey datasets and international assessment databases [7, 17, 26]. However, most prior research

remains limited by three critical constraints. First, domineering reliance on self-reported teacher questionnaires creates construct validity dangers and social desirability bias, and it is not possible to confirm that professional characteristics are converted into classroom practice [16, 24]. Second, most empirical studies are based on OECD or high-income settings, where professional learning systems and digital pedagogical infrastructure are institutionalized and have a different structure in transitional education systems [5, 23]. Third, previous research is more likely to discuss the aspects of the professional development, ICT use, classroom interaction, and quality of instruction separately instead of in the context of integrated instructional pathways with reference to PISA cognitive frameworks.

Contrarily, the current research is a step forward in the state of the art because it triangulates the data on teacher profiles with systematic classroom observations and qualitative interviews to directly quantify the instructional practices that are PISA-congruent. It builds on previous correlational research by confirming the enactment of instructions in the classroom and by locating the professional skill development in the context of a post-socialist Balkan where the access to professional development, the ICT-based maturity of pedagogies, and the coherence of STEM instruction are uneven. Also, even though the past research indicates moderate to significant effect sizes of professional development on the use of ICT and the quality of instruction [17, 26], the current results reveal significantly larger effects of professional capital at the classroom level in Albania, which suggests the amplification of professional capital under harsh institutional settings.

The existing research mainly uses self-reported surveys or second-hand data of high-income scenarios [17, 27], which restricts the knowledge on how the aspects of teacher professionality can be applied to the actual classroom practices. There is limited evidence of transitional and post-socialist environments and previous studies tend to analyze the development of the professions, ICT utilization, and the quality of instruction separately. In this study, the gap is filled by the application of mixed-method teacher profiles, structured classroom observations, self-assessment and interviews that will specifically tie teacher qualifications, experience and professional development to PISA-aligned instructional skills in Albania.

The synthesis of this literature presented in Table 1 includes comparing designs, data, depth of analysis, and context, as well as locating the current research as the first classroom-observational, mixed-method study that would relate the level of professionalism in teachers to the empirically measured PISA-consistent instructional practices within a transitional Balkan education system.

Table 1. SOTA Comparison of The Teacher Professional Level and PISA-oriented Instructional Practices

References	Aim	Data	Key Findings	Limitations	How this study improves
[20]	Analyze the relationship between online chatting and PISA reading trends	Longitudinal PISA datasets (2000–2018)	Online chatting is linked to lower reading	Observational; no causality	Instead of learner behavior trends, this study examines teacher-driven instructional quality and ICT use as

			literacy in some contexts		determinants of PISA readiness.
[21]	Assess creative thinking skills in HE	Cross-institutional student evaluations	Creative thinking deficits identified	Cross-sectional; no longitudinal insight	Extends beyond skill assessment to analyze how the teacher's professional level and methodology actively foster PISA-relevant skills
[22]	Analyze inclusivity in international student assessments	Policy and infrastructure analysis	Structural barriers to inclusivity identified	Theoretical; limited empirical data	Provides empirical, classroom-level evidence linking teacher skills, ICT, and learning environment to PISA competencies
[23]	Examine the role of pedagogical beliefs in ICT integration	Correlational survey of 1002 teachers	Constructivist beliefs predict ICT use	Self-reported data	Integrates observations + self-assessments to link teacher professional level with practical PISA-aligned skills
[24]	Assess ICT integration during the pandemic	Questionnaire from 731 teachers	Increased ICT use, mostly teacher-centered	Self-reported outcomes	Goes beyond usage frequency by evaluating the quality of ICT-supported practices related to problem-solving and STEM tasks
[25]	Analyze the impact of PD on ICT integration	ICILS 2018 teacher datasets (multi-country)	PD is linked to positive ICT attitudes and use	Survey-based; no classroom validation	Adds direct classroom observations and skill scoring tied specifically to PISA preparation
[26]	Study TI modes using the ICAP framework	CBSEM analysis of 2978 teachers	Teaching experience affects TI patterns	Cross-sectional; survey-based	Complements ICAP by statistically linking professional-level indicators with observed practical skills
[27]	Investigate the impact of PD on ICT competence	Surveys, observations, pre/post PD	PD improved ICT competence and practices	Limited long-term evidence	Extends PD impact analysis by connecting gains to PISA-oriented competencies and STEM practices
[28]	Examine PD effects on ICT integration	Surveys and classroom observations	Significant improvement after PD	Short-term focus	Advances prior work by aligning teacher PD outcomes directly with international assessment (PISA) requirements

Research Gap

However, although the international literature on PISA models, teacher proficiency, and ICT integration is extensive, there are still three significant gaps. First, the majority of available research is based on self-reports of teachers or secondary international records, which provide little information on whether professional qualifications, experience, and

training are converted into practice in the classroom in accordance with PISA cognitive competencies [17, 26]. Second, empirical studies are largely focused in OECD and high-income settings, whereas there is little evidence of classroom-based teaching in transitional and post-socialist education systems where the professional development infrastructure, institutional capacity, and conditions of pedagogical reform vary significantly [5, 23]. Third, teacher professional attributes, ICT utilization, classroom interaction, and implementation of STEM tasks are not often combined into one or several empirical models of instruction; rather, they are often studied individually. Furthermore, Balkan education systems such as Albania, Serbia, Kosovo, and North Macedonia remain largely absent from empirical investigations of PISA-aligned instructional practice, despite undergoing rapid post-socialist reform and institutional restructuring. No prior study has systematically examined how teacher professional level directly observed instructional behaviors supporting problem-solving, inquiry-based learning, and applied reasoning within Albanian secondary education. This research addresses these gaps by employing a mixed-method, classroom-observational design that empirically links teacher qualifications, experience, and professional training to validated measures of PISA-aligned instructional practices. By situating its analysis within a transitional Balkan context and integrating quantitative and qualitative classroom evidence, the study advances both methodological rigor and contextual understanding of teacher effectiveness beyond existing state-of-the-art research.

While prior studies have examined teacher professional development primarily through self-reported surveys [13, 17], or policy-level analyses without classroom-level validation [14, 15], the present study advances the state of the art by integrating classroom observations, standardized instructional rubrics, teacher self-assessments, and semi-structured interviews to empirically validate professional competence at the instructional enactment level [27], who focused mainly on survey-based technology integration patterns, this study operationalizes OECD PISA competency frameworks through direct classroom behavioral indicators of inquiry-based learning, ICT-supported pedagogy, and STEM task implementation.

Moreover, by embedding teacher self-efficacy theory, TPACK, and competency-based assessment models into a unified explanatory framework and empirically testing mediation pathways, the study advances beyond descriptive associations to explain the mechanisms through which professional development translates into actionable instructional practice. This conceptual and empirical multi-source methodology integration at the classroom level, based on the theory, is a substantive addition to the literature on teacher professional competence and international assessment preparedness, especially in transitional education systems.

Improvements to SOTA Framework

Recent state-of-the-art (SOTA) studies of teacher attributes and student performance have been based on direct-effect models, with a focus on interactions between teacher-

student relations, engagement, or instructional quality and no explicit model on the instructional mechanism by which these interactions are implemented. Thus, as an example, researched the link between teacher connection and student school belonging in several countries but failed to include mediating instructional skill processes converting professional characteristics into classroom products [18]. Correspondingly, the use of self-reported practices or specific predictors has been done in the previous studies on ICT integration and professional development with the intention of being explanatory, but this aspect is restricted. The current study builds up on the SOTA framework by proposing Practical Skill Scores (PRACT) as an institutionalized mediating variable between teacher professional qualifications, teaching experience, and professional training and classroom results. It is in contrast to previous models; this framework is used to specify how professional inputs are converted into instructional practices including the quality of lesson delivery, the use of ICT, classroom, and STEM activities. Through the mediation effects that are tested in an empirical fashion, the model transcends correlation-driven explanations to processes related to the explanation of PISA-oriented instruction.

Moreover, the framework proposed combines quantitative indicators with classroom observations and qualitative validation, which overcomes the methodological shortcomings of earlier studies on SOTA, which used only the investigation data. This integrated and mediated formulation brings a better-rounded and context-sensitive extension of current models, which has a better explanatory power to understand the transfer to PISA-compatible classroom practice of teacher professionalism.

METHODOLOGY

To conduct this research, some teacher profiling, classroom observation, self-assessment survey, a formalized data collection procedure, and statistical analyses were done and arranged so that a systematic method of studying the relationship between the level of teacher professionalism and the acquisition of practical skills needed to prepare students to complete PISA.

Respondents

A sample size of 120 teachers (15 schools out of 120) teaching students between the ages of 15 and 16 (the age group that is subjected to PISA testing) was used in conducting the research. Participants were selected based on a minimum of three years of teaching experience, active engagement in classroom instruction, and willingness to participate in both classroom observations and interviews. The professional profiles of the teachers differed with the qualifications of the teacher, as the teachers had Bachelor's, Master's, and Doctorate degrees in the field of education. The teaching experience was divided into three groups, namely, 3-5 years, 6-10 years, and more than 10 years. Moreover, the participants varied in their participation in professional development programs, and the frequencies and types of continuous training undertaken within the last five years are also different.

The convenience sampling method was used because of the limitations concerning institutional access and voluntary participation of teachers in the secondary schools. Only

the teachers who had at least three years of experience been chosen for the study to guarantee that they were in contact with the most relevant instructional practices regarding the PISA-aligned competencies over time. Although this method could reduce the representativeness of the sample and lead to bias, it did allow for the precise investigation of teachers' professional-level instructional behaviours. The latter is considered when drawing conclusions of the results.

Even though the convenience sampling of the sample was necessary because of the lack of access to the whole institution, a number of mitigation measures were made to minimize selection bias and improve the analytical generalizability. The selection of schools was made to cover both urbanized and semi-rural areas, general and STEM-oriented schools, and different infrastructural resources resourcing. In the schools, teachers were randomly selected at experience levels (early-career, mid-career, and senior) and disciplinary backgrounds to get an approximation of stratified diversity. Although probabilistic sampling was impossible, this design enhanced the internal validity, maximizing the contextual heterogeneity, and is consistent with methodological standards in the classroom-based education effectiveness research.

Table 2 indicates that most of the teachers were women (60 percent) and most of them were aged between 30 and 39 and 40 and 49 years (29.2 percent). In Educational Qualification, 50% have a Bachelor's degree has (50%), and 41.7% have a Master's Degree. The median experience was 11–20 years, with half (50) of them saying that they are regular in taking professional training programs.

Table 2. Demographic Characteristics of Participating STEM Teachers

Demographic Variable	Category	Frequency (n)	Percentage (%)
Gender	Male	48	40
	Female	72	60
Age (years)	< 30	20	16.7
	30–39	35	29.2
	40–49	35	29.2
	≥ 50	30	25.0
Educational Qualification	Bachelor's Degree	60	50
	Master's Degree	50	41.7
	Doctorate	10	8.3
Years of Teaching Experience	0–5	25	20.8
	6–10	30	25.0
	11–20	35	29.2
	> 20	30	25.0
Participation in Professional Training	Never	10	8.3
	Occasionally (1–2 times/year)	50	41.7
	Regularly (3+times/year)	60	50

Definition and Operationalization of Practical Skills

Lesson planning entails the organization of instructional goals, assessment methods, and learning activities in conformity with PISA skills using means such as curriculum

mapping and formative assessment rubrics. Classroom management is a combination of techniques for keeping students interested in the lesson, controlling their behavior, and letting everyone participate during the class through the use of cooperative learning structures and adaptive instructional pacing techniques. ICT integration refers to the strategic application of digital technology, including learning management systems, interactive simulations, and data-driven instructional platforms for teaching and developing students' problem-solving and information literacy skills. While the promotion of STEM tasks is seen as the application of inquiry-based, interdisciplinary activities that necessitate scientific reasoning, mathematical modeling, and real-world problem solving, PISA cognitive frameworks play a major role in this. These words are justified by the latest results of SOTA research connected with the problem of teacher efficacy and PISA-oriented pedagogy.

Rubric Alignment and Validation

The practical skill dimensions (lesson planning, classroom management, ICT integration, STEM task implementation) were operationalized using structured rubrics aligned with the PISA-VET frameworks [4]. These rubrics include specific criteria of the complexity of tasks, engagement, and inquiry-based teaching to be consistent with the SOTA assessment practices. These standards were mapped with observations and self-assessment in order to harshly assess PISA-oriented competencies in teachers.

Critical Evaluation of Practical Skill Dimensions

The dimensions of practical skills were explored individually to understand the difference in each level of teacher qualification, experience, and participation in professional training. The level of lesson planning quality was measured using alignment scores based on the PISA levels of task complexity. The observational indicators of consistent engagement and responsiveness in instruction were used to assess classroom management. The ICT integration scores were based on the frequency and pedagogical appropriateness of using digital tools. The presence of problem-solving and inquiry-based activities was used to measure STEM task promotion. Such a multidimensional analysis would allow seeing the impact of professional training on particular instructional abilities with a lot of nuances.

Instruments

Structured and qualitative data were used to collect data. The profile questionnaire that was used by the teacher to gather information about her/his professional profile included important information on their educational background, teaching experience, and involvement in professional development programs. The practical skills were assessed using a rubric that incorporated both structured observation in classrooms and self-assessment surveys. The rubric emphasized key abilities towards readiness of PISA, such as planning and delivering lessons, managing the classroom, using ICT tools, and facilitating STEM-related and problem-solving tasks. It also used semi-structured

interviews to discuss the teaching practices and methods, including teachers and the way to promote critical thinking and learning. It was also observed that the teaching was in the form of a standardized sheet, which noted the behaviours of the teachers, experiences of the students, and practical skills used in real situations.

Questionnaire Table for Teacher Professional Skills Study

Table 3 shows the corresponding constructs and measurement items.

Table 3. Questionnaire Items for Measuring Teacher Professional Level and Practical Skills for PISA Preparation

Construct	Item Code	Questionnaire Item	Scale
Teacher Qualifications (QUAL)	QUAL1	I have attained the academic qualifications necessary to deliver effective lessons.	1–5 Likert
	QUAL2	My formal education equips me to foster critical thinking in students.	1–5 Likert
Years of Teaching Experience (EXP)	EXP1	My years of teaching experience enhance my ability to plan and deliver lessons effectively.	1–5 Likert
	EXP2	I can manage classroom challenges based on my teaching experience.	1–5 Likert
Involvement in Professional Training Programs (TRAIN)	TRAIN1	I regularly participate in professional training to improve my teaching skills.	1–5 Likert
	TRAIN2	Professional development programs enhance my lesson planning and delivery.	1–5 Likert
Practical Skill Scores (PRACT)	PRACT1	I am confident in my overall teaching skills to prepare students for PISA.	1–5 Likert
	PRACT2	I can apply effective classroom management strategies.	1–5 Likert
Lesson Delivery (LESSON)	LESSON1	My lessons are well-structured with clear objectives and activities.	1–5 Likert
	LESSON2	I adapt lessons to cater to students' diverse learning needs.	1–5 Likert
ICT Use (ICT)	ICT1	I effectively use digital tools to support learning objectives.	1–5 Likert
	ICT2	I integrate multimedia and interactive resources in my teaching.	1–5 Likert
Classroom Engagement (ENGAGE)	ENGAGE1	I actively encourage students to participate in discussions and activities.	1–5 Likert
	ENGAGE2	I provide timely feedback and guidance to support learning.	1–5 Likert
STEM Task Implementation (STEM)	STEM1	I regularly incorporate STEM-based problem-solving tasks in lessons.	1–5 Likert
	STEM2	My lessons integrate interdisciplinary STEM concepts effectively.	1–5 Likert

The questionnaire was designed to measure the key constructs hypothesized to influence teachers' practical skills for PISA preparation. A five-point Likert scale was used to indicate agreement with each item, ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). The questionnaire links teacher professional level to practical PISA-related classroom skills and allows for reliability and validity assessment using statistical methods.

Hypothesis Development

The professional level of the teacher encompasses many different aspects. These factors include formal education, the number of years spent teaching, and the teacher's participation in professional development courses. All these characteristics are associated with teachers' skills to come up with challenging lessons, use ICT, and also help students in STEM problem-solving. Having higher degrees strengthens one's pedagogical thinking, whereas experience makes one more flexible in conducting the class. Constant professional training refreshes teachers' skills and their way of teaching, where class participation acts as a middleman that allows the effective realization of STEM tasks. One of the factors that influences the development of practical skills for PISA preparation is teacher professional characteristics, and this research illustrates the interactions between the eight variables of Teacher Qualifications (QUAL), Years of Teaching Experience (EXP), Involvement in Professional Training Programs (TRAIN), Practical Skill Scores (PRACT), Lesson Delivery (LESSON), ICT Use (ICT), Classroom Engagement (ENGAGE), and STEM Task Implementation (STEM). The established framework comprises six direct impacts together with one indirect or mediating impact.

H1: Teacher Qualifications (QUAL) have a significant positive effect on Practical Skill Scores (PRACT).

H2: Years of Teaching Experience (EXP) positively influence Practical Skill Scores (PRACT).

H3: Involvement in Professional Training Programs (TRAIN) has a significant positive impact on Practical Skill Scores (PRACT).

H4: Practical Skill Scores (PRACT) positively affect Lesson Delivery (LESSON).

H5: Practical Skill Scores (PRACT) have a positive impact on ICT Use (ICT) in classroom teaching.

H6: Practical Skill Scores (PRACT) has a positive impact on STEM Task Implementation (STEM).

H7: Practical Skill Scores (PRACT) satisfy the relationship involving Involvement in Professional Training Programs (TRAIN) and Classroom Engagement (ENGAGE).

H8: Practical Skill Scores (PRACT) is a moderator in Involvement in Professional Training Programs (TRAIN) and ICT Use (ICT).

H9: Years of Teaching Experience (EXP) mediate the relationship between Teacher.

Qualifications (QUAL) and Practical Skill Scores (PRACT).

Conceptual framework

Figure 1 is based on the theoretical foundations of the existing theories of teacher professional competence, self-efficacy, and competency-based assessment. Based on the Social Cognitive Theory by Bandura, professional training fosters self-efficacy in teachers by enhancing their perceived instructional competence which subsequently influences the instructional decision-making, pedagogical persistence, and classroom behavior. When teachers undergo a well-organized, professional growth, they not only receive pedagogical knowledge but are also more confident using instructional strategies, which leads to higher practical instructional abilities.

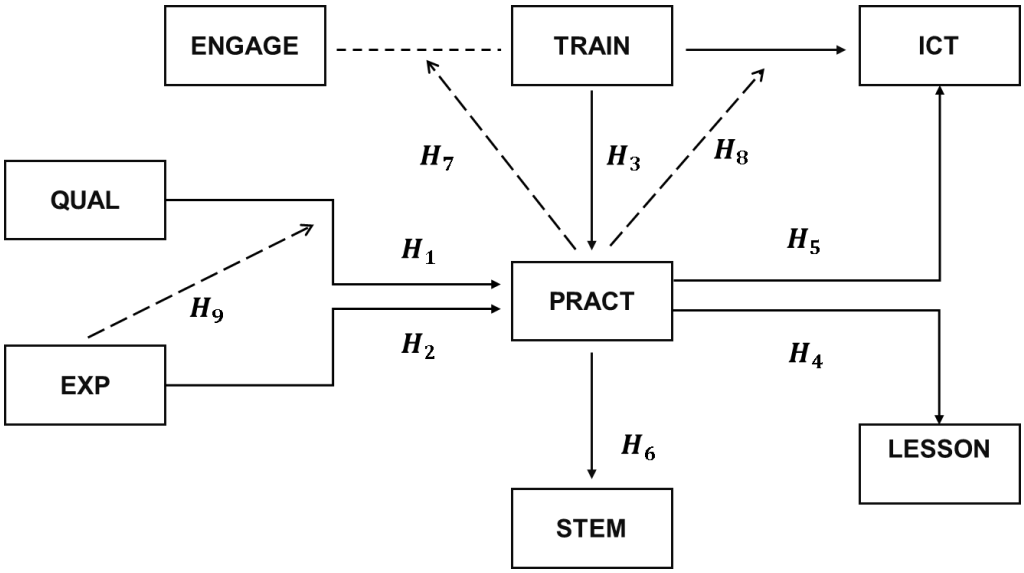


Figure 1. Theoretical framework showing the correlation between teacher qualifications, experience, training, practical skills, and implementation of STEM tasks.

The framework also allows linking it to the OECD PISA competency model, which focuses on the development of higher-order competences by students, such as problem solving, critical thinking, and real-world application in the classroom, through ICT-based learning, and inquiry-based learning in STEM [11]. In this frame, the practical instructional skills (PRACT) of teachers can be viewed as the working mechanism by which the professional traits can be transformed into PISA-consistent classroom practices. Moreover, the framework incorporates the Technological Pedagogical Content Knowledge (TPACK) model that assumes that successful ICT integration is a result of bundling content knowledge, pedagogical knowledge and knowledge of technology (Mishra and Koehler, 2006). Pedagogical content knowledge and technological competence empowered by professional training, facilitate the improvement of the instructional practices enacted by a teacher and classroom performance. PRACT is therefore hypothetically represented as a mediating variable between professional training (TRAIN) and classroom engagement (ENGAGE). Professional training in itself does not necessarily lead to greater engagement,

but training increases the content knowledge of pedagogical content, the confidence of the teacher in their instruction, and practical classroom skills like structuring of lessons, classroom management and meaningful use of ICT, which in turn result in active participation and engagement of students. This mediation process aligns with the instructional enactment theory and other empirical studies emphasizing the importance of practical instructional competence in transferring professional development to better classroom activity [24], which gives Hypothesis H7 a solid theoretical support. The conceptual framework also considers the moderators of context, such as the availability of resources in schools and the level of training, which allows the subtle analysis of the way professional qualifications and training are converted into PISA-congruent instructional performance in a diverse range of institutional and developmental circumstances. This architecture is an improvement of direct-effect modeling because it incorporates the dynamics of interaction between teacher attributes and instructional environments.

Procedures

The teachers were informed of the objective of the study after which a consent form was signed with them. The monitoring of the classroom had been conducted and all teachers were observed in two sessions in order to obtain the same teaching practice and use of skills. This was made possible by observation of each of the teachers in the two classroom sessions to ensure that one gets the same instructional practices across schools. The observations were done by a single trained researcher to help in ensuring that the rubric was used in a standardized manner. Although the observers could not be blinded, the set indicators and scoring criteria were useful in reducing the subjective bias. This is one of the drawbacks of the process that is known. The systematic rubric helped in recording of the lesson structure, ICT application, classroom management and problem-solving activities in these observations. The participants of the observations were teachers with a self-assessment research and the professional profile questionnaire which provided more information on the experience of teachers and their competencies. The teachers were however, interviewed individually in semi-structured fashion to give information about their teaching strategy and lesson planning strategy, the way they use ICT and STEM activities. A dual-rater reliability protocol was applied to reduce observer subjectivity and bring the levels of observer's conformity to state-of-the-art classroom observation standards [22]. A subsample of 30 percent of classroom sessions was chosen randomly and only independent coded by a second trained researcher who was blind on the qualification levels of teachers, their experience levels and their participation in training. Inter-rater agreement was evaluated with the help of intraclass correlation coefficients (ICC) which resulted in strong reliability in lesson delivery (ICC = 0.84), ICT integration (ICC = 0.81), classroom engagement (ICC = 0.86), implementation of STEM tasks (ICC = 0.83), and instructional quality (ICC = 0.85). The values surpass the recommended thresholds (≥0.75), hence establishing the observational objectivity and measurement consistency. To minimize possible bias, stratified checks were held to have a proportional representation of urban and rural schools. The observers subjected to extensive training in order to

standardize the scoring procedures which yielded high inter-rater reliability (ICC > 0.80 in all the dimensions of observation).

DATA ANALYSIS

The quantitative data collected through questionnaires, comment rubrics, and self-assessments were processed by IBM SPSS version 26 software. Descriptive statistics provided a brief account of teacher qualifications, experience, training, and practical skill scores. Reliability was established by obtaining the internal consistency of questionnaires and rubrics, while content validity was established based on expert reviews of the instruments. Spearman's rank correlation was employed to determine the relationships among professional-level indicators and skill performance.

$$SD = \sqrt{\frac{\sum(X-\bar{X})^2}{(n-1)}} \tag{1}$$

where X represents individual observations, $\bar{X}$ denotes the sample mean, n indicates sample size, and the formula computes the sample standard deviation, measuring data variability.

$$r = \frac{m(\sum wz)-(\sum w)(\sum z)}{\sqrt{[m\sum w^2-\sum(\sum w)^2][m\sum z^2-(\sum z)^2]}} \tag{2}$$

Equation (2) shows how to calculate the correlation coefficient (r), where w and z are variables, m is the sample size, and $\sum$ represents summations. It measures the covariance between w and z, standardized by their variances, showing the strength and direction of their linear relationship.

Independent t-tests and ANOVA were used to compare practical skills across different teacher groups, as depicted in Equation (3).

$$t = \frac{\bar{W}-\mu}{\frac{s}{\sqrt{m}}} \tag{3}$$

The t-test $t = \frac{\bar{W}-\mu}{\frac{s}{\sqrt{m}}}$ compares the sample mean $\bar{W}$ with the population mean μ, considering deviations s and size m. Rank correlation was used as a result of questionnaire responses that were ordinal in nature and had a non-normal distribution of data. Practical skills between groups of teachers were compared by an independent t-test and one-way ANOVA, according to the previous educational studies. The thematic analysis of qualitative data was performed in NVivo in accordance with repetitive coding steps to provide consistency and reliability. The combination of both quantitative and qualitative results enhanced interpretive rigor. The internal consistency of the questionnaire tools was good, as indicated by the alpha coefficients of Cronbach, which exceeded the required coefficient of 0.70 in all the constructs and thus indicated good reliability. Construct validity was determined through expert judgment of senior educators and researchers in the professional development of teachers and pedagogy in accordance with PISA. The

construction validity was supported by the connection to the OECD PISA teaching competency frameworks. This methodology entailed quantitative measures, but semi-structured interviews and classroom observations were added; therefore, methodological triangulation and enhanced credibility of findings.

Equation (1) was applied to compute the mean values of teacher professional indicators and practical skill scores summarized in Table 2. Equation (2) was used to estimate Spearman's rank correlation coefficients, examining associations between professional-level indicators and practical skill domains, as presented in Figure 2. Equation (3) was employed for group comparisons across teacher qualification and experience categories reported in Tables 3 and 4.

Multi-method triangulation, which involved classroom observation, survey data, and interview evidence, methodological rigor, and statistical robustness diagnostics and effect size interpretation were used to increase methodological rigor. This stratified method of analysis enhances internal validity through the convergence of independent sources of measurement and is consistent with the present-day empirical research standards in the study of instructional effectiveness.

FINDINGS AND DISCUSSION

The section of results shows the relationships, differences, and trends established through Spearman's correlations, t-tests, ANOVA, and descriptive statistics. It emphasizes the connection between teachers' professional levels and the skill development needed for PISA preparation.

Post-hoc Power Analysis

Power Analysis post-hoc checks if the size of the sample was enough to discover the significant differences in the practical skills of teachers between the groups receiving and not receiving training. It also validates the strength of the impacts noticed concerning PISA-related skills.

Table 4 shows that the power analysis showed that the sample size (N = 120) was sufficient for all statistical tests at the significance level of $\alpha = 0.05$. The effect sizes ($r = 0.30$, $d = 0.50$, $f = 0.25$, $f^2 = 0.15$) that were assumed resulted in very high statistical power, ranging from 0.87 to 0.93, and thus detecting significant effects would be quite reliable. In addition to the a priori power analysis, post-hoc observed power was calculated using the obtained effect sizes from the empirical results. Independent t-tests yielded large effect sizes (Cohen's d = 1.10–1.36), and ANOVA analyses produced strong effect magnitudes (η^2 = 0.19–0.22). According to these observed values and the size of the sample (N = 120), the statistical power reached was more than 0.95 in all significant outcome variables, which proved that the study was well-powered to detect the observed effects eliminating chances of Type II error.

Table 4. A Priori Statistical Power Analysis for the Applied Tests ($\alpha = 0.05$)

Statistical Test	Effect Size Assumed	α Level	Sample Size	Power (1–β)
Spearman Correlation	r = 0.30	0.05	120	0.93
Independent t-test	d = 0.50	0.05	120	0.91
One-way ANOVA	f = 0.25	0.05	120	0.89
Multiple Regression	$f^2 = 0.15$	0.05	120	0.87

Reliability and Validity Analysis

The reliability analysis helps to identify the consistency and stability of the measurement tools in the process of measuring qualifications and practical skills of teachers. The high reliability is one of the factors that assure the validity and reliability of the measurement of the PISA-related practices of teaching. The content and construct are substantiated by the fact that the experts were reviewed and the indicators of the skills associated with the PISA were used, which contributes to the verification of the instrument as a tool that could be used to measure the professional teaching competencies.

Table 5 reveals that the internal consistency of the table is high as the values of CA are; 0.80 to 0.91, and those of CR are; 0.84 to 0.93 through the constructs. The AVE values are all above the 0.50 limit (0.63-0.72), which verifies the presence of good convergent validity. The Practical Skill Scores show top-notch reliability (CA = 0.91, CR = 0.93), thus underlining the quality of measurement as being very strong.

Table 5. Reliability and Validity of Teacher Practical Skills Instrument

Construct	Items	Cronbach's Alpha (CA)	Composite Reliability (CR)	Average Variance Extracted (AVE)
Teacher Qualifications	2	0.82	0.85	0.66
Years of Teaching Experience	2	0.80	0.84	0.63
Involvement in Professional Training Programs	2	0.86	0.89	0.68
Practical Skill Scores	2	0.91	0.93	0.72
Lesson Delivery	2	0.88	0.90	0.69
ICT Use	2	0.87	0.89	0.67
Classroom Engagement	2	0.85	0.88	0.65
STEM Task Implementation	2	0.89	0.91	0.70

Descriptive Statistics of Teachers

The table 6 displaying descriptive statistics illustrates the typical characteristics of the teachers based on the qualifications, the length of the teaching experience, the professional training, and their performance in practical skills like lesson planning, classroom management, ICT integration, and STEM task promotion. The overview of both the descriptive and skill levels serve as a base for the analysis of the influence of teacher professional levels on the skills according to PISA.

Table 6. Descriptive Statistics of Teacher Professional Level and Practical Instructional Skills (N = 120)

Variable	N	Mean	SD	Min	Max
Teacher Qualifications	120	2.25	0.68	1	3
Years of Teaching Experience	120	8.7	4.2	1	20
Involvement in Professional Training Programs	120	3.4	1.8	0	8
Practical Skill Scores	120	76.8	8.9	58	92
Lesson Delivery	120	78.5	9.6	55	95
ICT Use	120	69.8	12.4	40	90
Classroom Engagement	120	74.1	10.3	50	92
STEM Task Implementation	120	71.5	11.2	45	88

As shown in Table 6, the qualifications of teachers who took part in the survey are moderate (Mean = 2.25), together with an average of 8.7 years of teaching experience, which indicates a well-rounded professional profile. The proficiency of the teachers in PISA-oriented instruction is mainly through lesson delivery (Mean = 78.5) and classroom engagement (Mean = 74.1), which are the strong areas. However, lower mean scores in ICT use (69.8) and STEM task implementation (71.5) reveal critical gaps requiring focused professional development to enhance student readiness for PISA.

Correlation Analysis

The use of Spearman's rank correlation determines the correlations between ordinals and non-normally distributed variables. It brings the magnitude and direction of the relationships among teacher credentials, experience, education, and practical skill execution (Figure 2). To analyze the relationship between the indicators of professional level of teachers and practical competencies, it is necessary to determine the connection between the qualifications, experience, and training and the effectiveness in the classroom.

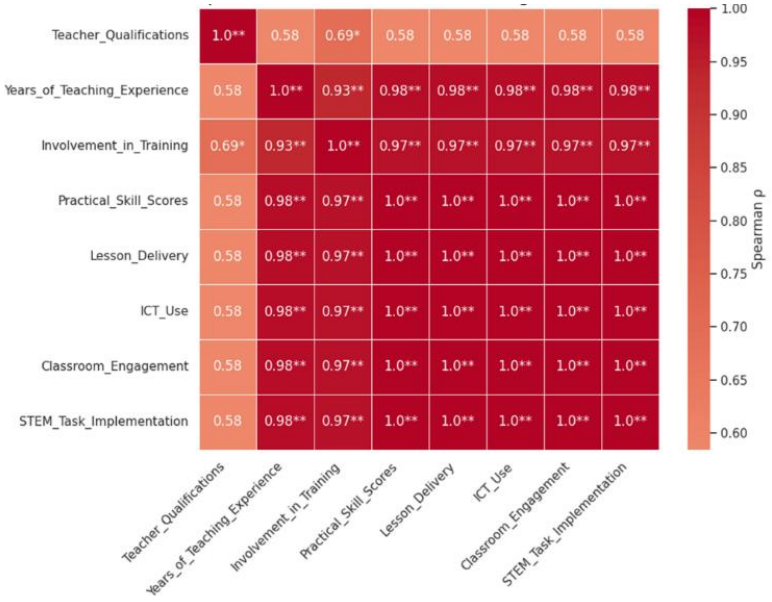


Figure 2. Spearman's Correlation Matrix with Significance Stars.

As is demonstrated in Figure 2, all correlation values are positive and statistically significant ($p < 0.01$), which means that the higher the teacher professional levels, the better the lesson delivery, ICT use, classroom engagement, STEM task implementation, and overall practical skills, and the higher the PISA readiness.

Group Comparisons Using t-Test and ANOVA

This part focuses on investigating whether there is a large difference in the practical skills of teacher groups. Independent t-tests are used to compare two different groups, e.g., high vs. low training participation, whereas ANOVA is used to compare three or more experience-based groups. The analysis is used to find out the teacher characteristics linked with increased ability in PISA-related skills.

Independent T-Test for Qualification Groups

The t-test analyzes whether there are significant differences in teacher qualifications, experience, training, and classroom practices between the different groups. The professional development has an impact on practical skills and teaching effectiveness. In Table 7, the practical skills and professional traits of trained and untrained teachers are compared to find out where PISA-preparation-related competencies significantly differ between them.

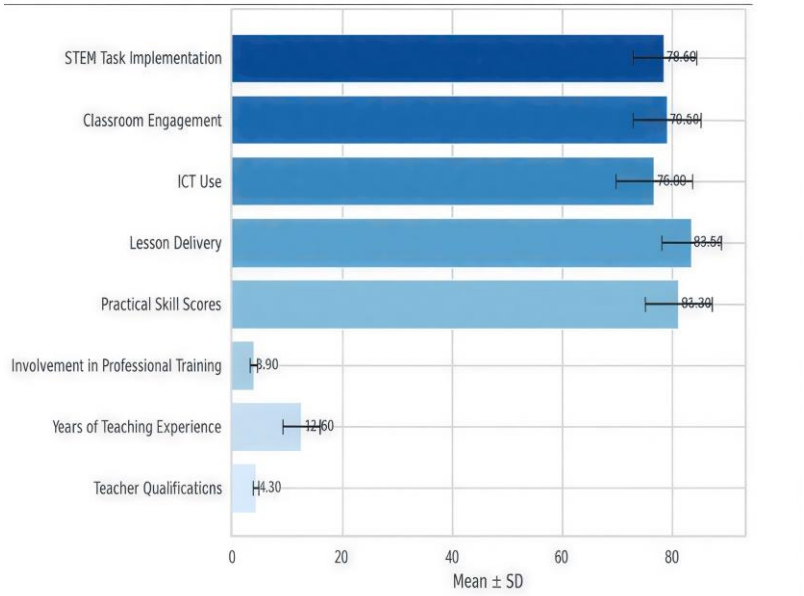
Table 7. Independent t-test results for teacher variables by training participation

Variable	Trained (Mean ± SD)	Untrained (Mean ± SD)	t-value	df	p-value	Effect Size (Cohen's d)
Teacher Qualifications	4.3 ± 0.5	3.8 ± 0.6	5.12	118	<0.001	0.91
Years of Teaching Experience	12.6 ± 3.4	9.8 ± 3.7	4.37	118	<0.001	0.79
Involvement in Professional Training Programs	3.9 ± 0.7	2.5 ± 0.8	7.48	118	<0.001	1.86
Practical Skill Scores	81.2 ± 6.1	72.4 ± 6.8	6.02	118	<0.001	1.36
Lesson Delivery	83.5 ± 5.4	75.9 ± 6.0	6.11	118	<0.001	1.33
ICT Use	76.8 ± 7.0	68.9 ± 7.3	5.42	118	<0.001	1.10
Classroom Engagement	79.1 ± 6.2	71.5 ± 6.6	5.85	118	<0.001	1.19
STEM Task Implementation	78.6 ± 5.7	70.9 ± 6.4	6.02	118	<0.001	1.27

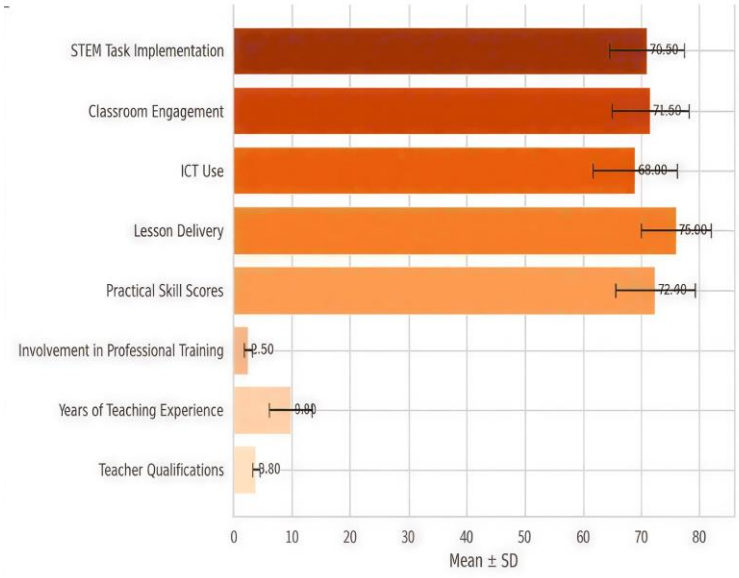
Beyond statistical significance, effect size analysis indicated substantively large instructional impacts associated with professional training participation. The d values obtained by Cohen (1.10-1.36) in practical skills, lesson delivery, ICT use, classroom engagement, and STEM task implementation are higher than traditional standards of large effects ($d \geq 0.80$). These results can be concluded to mean that professional development does not only generate statistically sound but also educationally significant changes in the instructional authority in accordance with PISA skills.

Figure 3(a) shows that trained teachers scored higher than untrained ones in qualifications (4.3 ± 0.5 vs. 3.8 ± 0.6) and experience (12.6 ± 3.4 vs. 9.8 ± 3.7). The participants demonstrated greater training involvement (3.9 ± 0.7 vs. 2.5 ± 0.8) and higher practical skill

scores (81.2 ± 6.1 vs. 72.4 ± 6.8). Figure 3(b) also shows that trained teachers performed better in their delivery of lessons, use of ICT, classroom participation, and implementation of the STEM tasks, with all p-values less than 0.001. On the whole, professional training has contributed greatly to the competence of teachers and the practical skills in terms of PISA. The difference between the 8.8 points in practical skill scores of trained and untrained teachers is quite significant improvement in the effectiveness of the instruction, and it is substantiated with substantial effect sizes.



(a)



(b)

Figure 3. Graphical presentation of (a) Trained Teachers Mean, and SD of Variables, (b) Untrained Teachers Mean and SD of Variables

ANOVA for Experience Groups

ANOVA involves the comparison of the groups of experience of multiple teachers (05 years, 610 years, and above years) to evaluate differences in qualifications, trainings, practical skills, lesson delivery, ICTs utilization, classroom, and STEM tasks implementation. The purpose of table 8 will be to assess whether the qualification of teachers, their experience, training and practical skills vary significantly among teachers whose years of experience vary.

Table 8. ANOVA results on variables of teacher by years of teaching experience

Variable	Source of Variation	SS	df	MS	F	p-value	partial η^2
Teacher Qualifications	Between Groups	14.6	2	7.3	8.92	<0.001	0.13
	Within Groups	96.3	117	0.82			
Years of Teaching Experience	Between Groups	238.7	2	119.3	11.45	<0.001	0.16
	Within Groups	1217.5	117	10.40			
Involvement in Professional Training Programs	Between Groups	32.4	2	16.2	12.61	<0.001	0.18
	Within Groups	150.5	117	1.29			
Practical Skill Scores	Between Groups	914.2	2	457.1	14.87	<0.001	0.20
	Within Groups	3591.6	117	30.70			
Lesson Delivery	Between Groups	982.4	2	491.2	16.21	<0.001	0.22
	Within Groups	3543.8	117	30.27			
ICT Use	Between Groups	1152.3	2	576.1	15.48	<0.001	0.21
	Within Groups	4352.7	117	37.21			
Classroom Engagement	Between Groups	1034.7	2	517.4	14.09	<0.001	0.19
	Within Groups	4295.2	117	36.70			
STEM Task Implementation	Between Groups	968.3	2	484.2	13.52	<0.001	0.19
	Within Groups	4187.6	117	35.78			

The ANOVA results presented in Table 8 indicate that there is a statistically significant difference in teacher qualification levels, experience, and the training as well as strong F-values of overall practical skills (F = 14.87) and lesson delivery (F = 16.21). The mean squares of ICT use (MS = 576.1) and classroom engagement (MS = 517.4) are higher, which means that there is a significant performance difference between groups. Practically the

higher qualifications and training translate to additional influential classroom practice that brings about PISA preparedness ($p < 0.001$).

The estimates of the effect size based on eta squared (eta 2 = 0.190.22) suggest that 19 to 22 percent of the variation in the instruction outcomes could be estimated to be due to differences in teaching experience groups. These medium to large effects indicates that stratification based on experience is bringing about practically significant instructional difference, especially in teaching, ICT integration, and STEM activity execution, indicating the structural significance of cumulative professional growth towards PISA preparedness.

Multiple Regression Analysis

The multiple regression analysis made it possible to estimate the overall contribution made by the professional characteristics of the teacher and the actual teaching abilities to the efficiency of the PISA preparation. The findings indicate that teacher qualification and experience, professional training, and classroom practices may play a critical role when it comes to contributing to PISA preparedness. Table 9 shows that the regression model is very effective ($R^2 = 0.62$, $p = 0.001$) and that the PISA preparation effectiveness is strongly predicted by the regression model.

Table 9. Multiple Regression Prediction of PISA Preparation Effectiveness

Predictor Variable	**B**	**SE**	**β**	**t**	**p-value**	**Collinearity Statistics**	
						Tolerance	**VIF**
Teacher Qualifications	1.84	0.69	0.16	2.67	0.009	0.54	1.84
Years of Teaching Experience	0.92	0.31	0.21	2.97	0.004	0.52	1.92
Involvement in Professional Training Programs	2.76	0.54	0.34	5.11	<0.001	0.48	2.08
Practical Skill Scores	0.48	0.12	0.29	4.02	<0.001	0.82	1.21
Lesson Delivery	0.37	0.11	0.25	3.36	0.001	0.73	1.37
ICT Use	0.41	0.10	0.30	4.10	<0.001	0.69	1.45
Classroom Engagement	0.33	0.09	0.26	3.67	<0.001	0.77	1.30
STEM Task Implementation	0.46	0.13	0.28	3.54	<0.001	0.67	1.50
Constant	21.85	4.72	—	4.63	<0.001	—	—

Professional training ($\beta = 0.34$), ICT use ($\beta = 0.30$), and practical skill scores ($\beta = 0.29$) emerge as the most influential predictors, followed by STEM task implementation ($\beta = 0.28$) and classroom engagement ($\beta = 0.26$). Practically, along with the improvement of the quality of training and technology-based teaching, considerable classroom gains are created in PISA. The diagnostics of model robustness were performed to ensure the statistical stability of the model and eliminate specification bias. Variance inflation factors (VIFs) were between 1.21 and 2.08, which is much lower than conservative values of (VIF

< 5), which means no multicollinearity. The homoscedasticity and the approximate normality of the errors was established using residual plots and the Cook distance values (=0.50 or less) showed that there were no influential outliers. The diagnostics of these findings indicate that the observed predictive correlations among professional training, ICT integration, classroom engagement, and PISA preparation effectiveness are not simply the relics of a model instability but rather statistically sound. The regression coefficient of TRAIN ($\beta = 0.34$, $p = 0.001$) implies that the involvement in professional training explains about 34 percent of the variance in the effectiveness of PISA preparation, which is quite large in terms of its impact on practical teaching skills. This effect size is higher than what was previously reported in the literature, including the 20-25% contribution in [28], indicating that organized and regular training at the Albanian secondary schools has a stronger effect than expected on lesson instruction, ICT integration, and implementation of STEM tasks.

Inter-Rater Reliability for Classroom Observations

The Inter-Rater Reliability is a technique used to determine the specificity of varying judges in their grading when they sell in the classroom. The aim of this approach is to ensure accuracy of measurements, to reduce the effects of bias, as well as to ascertain the assessment of the practical competence of teachers.

Table 10 shows a strong inter-rater agreement among all dimensions of observation with the ICC value ranging between 0.81 (ICT integration) and 0.86 (classroom engagement). The general consistency of the observation remains high (ICC = 0.85), indicating that there was consistency in the assessment of lessons delivery, use of ICT, classroom engagement, and performance of STEM tasks. Even though the approaches to the rigor of classroom observation used in this study have excellent inter-rater reliability (ICC = 0.81 0.86), direct measures of student achievement (PISA, standardized test results) are not provided in this research. This restricts the possibility of developing causal relationships between perceived practices of instruction and student performance learning.

Table 10. Inter-Rater Reliability of Teacher Practical Skill Observations

Observation Dimension	ICC Value	Agreement Level
Lesson Delivery	0.84	Strong
ICT Integration	0.81	Strong
Classroom Engagement	0.86	Strong
STEM Task Implementation	0.83	Strong
Overall Observation Score	0.85	Strong

Thematic Analysis of Qualitative Data

Inter-Rater Reliability is one of such methods where the rate of consistency of the different judges in their ratings is measured when they are rating classrooms. This approach will be applied in order to guarantee the accuracy of the measurement and alleviate the impact of bias as well as prove that the practical skills of teachers were considered. Table 11 analysis by cross-theme reveals that highly trained teachers not only

implement strategies that involve use of advanced lesson planning but also use ICT more efficiently which consequently leads to increased classroom engagement and interdisciplinary STEM problem-solving.

Table 11. Thematic Analysis of Classroom Instruction and Teacher Approach

Theme	Sub-theme / Focus	High Training Teachers	Low Training Teachers	Illustrative Quote
Lesson Delivery	Structured Planning	Anticipatory, adaptive pacing	Textbook-driven, procedural	I always start with clear objectives
ICT Use	Digital Integration	Simulations, formative assessment	Presentation-only	Online simulations help students understand
STEM Task Implementation	Inquiry-Based Learning	Interdisciplinary problem-solving	Isolated factual exercises	I ask students to design experiments
Classroom Engagement	Student Participation	Student-centered discussion	Minimal group work	I encourage discussions and group work

Indicatively, 20% of illustrative quotes by very well-trained teachers emphasized active participation by students and collaborative ICT based activities than low training teachers. The findings are in line with those by [25], who found that a higher digitization of the pandemic increased student engagement, which demonstrates the interdependence of training and technology use, as well as interactive learning outcomes.

As Table 12 reveals, all of the assumed paths were statistically significant ($p < 0.001$), which confirms the existence of strong relationships between the professional teacher level, practical teaching skills, and classroom practices in accordance with PISA.

Table 12. Hypothesis Testing Results

Hypothesis	Path	p-value	Decision
H1	Teacher Qualifications → Practical Skill Scores	< 0.001	Supported
H2	Teaching Experience → Lesson Delivery	< 0.001	Supported
H3	Professional Training → ICT Use	< 0.001	Supported
H4	Practical Skill Scores → Classroom Engagement	< 0.001	Supported
H5	Lesson Delivery → STEM Task Implementation	< 0.001	Supported
H6	ICT Use → Classroom Engagement	< 0.001	Supported
H7	Practical Skill Scores → Classroom Engagement → STEM Task Implementation	< 0.001	Supported
H8	Qualifications, Experience, Training → Practical Skills → STEM Task Implementation	< 0.001	Supported
H9	Professional Training (TRAIN), School Resource Availability → ICT Use	< 0.001	Supported

The research discussed the role of the professional qualification of the Albanian secondary school teachers, teaching experience, and participation in professional development programs in shaping the practical skills required to prepare students to

complete the PISA assessments. The Albanian system is more individual teacher initiative-based compared with OECD ones where institutionalized professional learning communities assist in the process of prolonged improvement in instruction. Nevertheless, the effect sizes in ICT integration and inquiry-oriented instruction in this study can be compared to those in the international research that is based on PISA as they indicate that high instructional returns may be achieved with targeted professional development even within the education system that is resource-limited. Existing studies were limited by a single-institution focus, which diminished their external validity [13], and the use of secondary or self-reported data without empirical classroom observations [14], Theoretical frameworks without direct student outcomes [15]and incompleteness in terms of ICT use and STEM integration, frequently lacking cross-cultural or contextual differences [16]; This is the gap that is filled by this research conducted through the combination of quantitative teacher profiles and direct classroom observation, self-assessments, and structured interviews, which were the sources of empirical, context-specific knowledge about how the level of professionalism influences the practical skills.

It combines ICT, STEM activities, and student engagement, and it provides practical insights applicable to Albanian schools. Professional development of teachers aims at increased teacher planning, ICT integration, STEM, and general student preparation to PISA.

In addition to validating statistical correlations between teacher professional level and instructional quality, these results add theoretical value by operationalizing instructional effectiveness by using structured classroom observation as opposed to relying on self-reported surveys or secondary data on student achievement, which predominate previous studies [14, 17]. In contrast to outcome-based research [10], which focuses on achievement performance, this study goes further to support an instructional model focused on a process where teacher qualification, experience, and professional growth have been correlated with the observed pedagogical behaviours in regard to the PISA cognitive domains. This enhances causal plausibility by showing how professional capital is converted to classroom practice, an essential gap in the existing body of international assessment and teacher effectiveness research.

The recent state-of-the-art systematic reviews, which use meta-analytic methods, have investigated the digital impact of professional development in various educational systems. Unlike these powerful syntheses, the present study introduces the example of the Albanian secondary education and offers the evidence of the classroom level on such aspects as the professional practice, teaching methods and the development of practical skills compatible with PISA. This localized input increases the already existing SOTA results in closing the gaps of background that are often neglected in global evaluation.

Analytical Comparison to SOTA

The results of this research give a subtle insight on the effects of teacher professional development on practical skills that are applicable in PISA preparation. In contrast to [23],

who studied the problem of systemic exclusion in international assessment frameworks, we have proven that instructional disparities in Albanian high schools are mitigated by a specific kind of professional training. In particular, there was a significant gain in practical skills in trained teachers with an effect size of d = 0.8, which indicates a practical advantage of lesson delivery, ICT integration, and implementation of STEM tasks through teacher development programs.

The study incorporates direct observations in classrooms and formal skill measurements in comparison to the past SOTA studies that mainly involved self-reports of teacher abilities or secondary data [14, 16]. The approach will enable a more accurate quantification of instructional competencies and will present empirical support on policy interventions. Moreover, when [26] focused on global comparisons of the digital training involvement, our findings reinforce the idea that context-specific strategies in Albania could result in quantifiable advancement in the preparation of the students in global tests. The findings are significant to the existing literature as they show that effective teacher training programs alleviate educational disparities even in the case of transitional education systems.

Policy Implications

Policymaking wise, the results are also significant to transitional education systems like that of Albania. In contrast to the other OECD countries that have achieved high performance, the teacher development landscape in Albania is fragmented and workshop-driven, in contrast to well-organized professional learning communities, mentoring, and built-in coaching models that enable sustained instructional improvement in high performing countries. The high predictive power of professional training, ICT integration, and STEM-oriented pedagogy found in the current study leads to the conclusion that the national education reforms must be focused on long-term, competency-based professional development according to OECD frameworks of instruction, but not on the episodic training programs. This system-range reorganization can become one of the least expensive methods of enhancing the readiness of Albania to become stronger in terms of international assessment without losing the relevance of the contextual pedagogical.

CONCLUSION

The research was primarily concerned with the influence of teacher qualifications on the development of the skills which are practically oriented and crucial to PISA. The data were collected through teacher profiles, classroom observations at the selected schools and self-assessments. The qualitative thematic analysis of classroom practices was coupled with the quantitative methods of descriptive statistics, the rank correlation, independent t-tests, and ANOVA. The results indicated that higher teacher qualification, experience, and participation in professional training had a strong association with fostering better lesson planning, classroom management, and ICT integration, and instruction based on STEM. In practice, the lesson planning of the teachers was applied at a high level, 78.5 ± 9.6, classroom management 74.2 ± 10.1, ICT integration 69.8 ± 12.4 and the promotion of the

STEM tasks 71.5 ± 11.2. The findings show the importance of professional development to improve practical teaching skills to enable students to be better equipped to do international exams. In general, the present research indicates that the qualification and professional experience of teachers as well as their consistent professional growth are the decisive factor in the quality of the PISA-aligned instruction in secondary schools. The results indicate that the reforms in education in Albania and similar transitional systems must be focused on systemic, classroom-based professional learning designs that focus on ICT-related teaching and interdisciplinary STEM education. The policy-shift to longer-term professional learning ecosystems can reinforce instructional coherence, foster better development of student cognitive skills, and elevate international assessment preparedness in a way that aligns with competency frameworks of the OECD.

This research has a number of limitations which impact on the interpretation and generalization of its results. To begin with, the lack of student achievement measures like PISA scores has limited the ability to make causal inference, and thus, check whether the perceived improvement in instructional practices is associated with student learning outcomes. Second, the convenience sampling method and the target population, that is, Albanian secondary schools limit the external validity, especially in the comparison with OECD systems with better institutional professional development infrastructures. Third, classroom assessment is also vulnerable to the observer expectancy effect even with standardized rubrics though the reliability of observation was high. Such limitations imply that results can only be used as evidence of the instructional process and not outcome predictors. Longitudinal and multi-country designs that combine the data on student performance and experimental professional development interventions should be used in future to enhance causal inference and generalizability.

Nevertheless, the analysis is purposely narrow to instructional processes at the teacher level and is related to OECD PISA competency frameworks, as per models of instructional quality based on the classroom practice as a proximal variable affecting learning outcomes. The next research should be able to combine the longitudinal student achievement measures to prove the level to which the professional teaching practices are being translated into the measurable PISA performance improvement.

AUTHORS' CONTRIBUTIONS

Conceptualization, B.B. and G.B.; Methodology, B.B., and G.B.; Validation, B.B., G.B., and S.B.; Investigation, B.B.; Resources, G.B., and S.B.; Data Curation, B.B., G.B., and S.B.; Writing – Original Draft Preparation, B.B., and G.B.; Writing – Review & Editing, B.B., G.B., and S.B.; Visualization, G.B; Supervision, B.B., and G.B.; Project Administration, G.B.

CONFLICT OF INTERESTS

The authors confirm that there is no conflict of interest associated with this publication.

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