



Teachers' Perceptions of Using ICT in Science Instruction in Pre-University Settings

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Abstract

ICT is one of the essential cornerstones of modern society. Preuniversity schools in Albania are provided with access to a large array of innovative, high-quality science-based ICT resources. In terms of classroom processes, supervision, individual use, and professional growth, this study attempts to highlight how science teachers use ICT. Evidence on how science teachers pick and deploy ICT-based instructional technologies to teach science is limited. This served as the impetus for the current study, which seeks to discover the sorts of ICT-based teaching aids that science instructors are most likely to apply, as well as the factors that impact their decision. This study is focused on issues like: (i) what factors determine teachers' decisions to employ ICT-based instructional instruments when teaching science; and (ii) which ICT-based teaching tools do educators in secondary schools apply while teaching science. The value of this study rests in its ability to assess how much science teachers apply the ICT-based instructional devices to teach science. Additionally, it will offer relevant information from the opinions of science instructors regarding how the concrete practical usage of ICT influences the daily incorporation of ICT-based teaching aids into science classroom. Eighty science teachers employed by South Albanian schools contributed the data. A self-made questionnaire was utilized to acquire information on the aforementioned domains. The chosen persons' prior agreement and assent were acquired before any data was collected. When it comes to how science teachers evaluated the use of ICT in the classroom, the results showed that the vast majority of them were largely favorable about using ICT in the classroom, and the factor that motivates them most in using ICT is to make their teaching practice more effective. It also results that insufficient time to integrate ICT in their teaching is considered the greatest barrier, and the most effective way to gain digital skills is reported to be attending the workshops, trainings, and online courses.

Keywords: ICT; science teaching; educational technology; secondary education

1. Introduction

Since when computers were first utilized in classrooms in the early 1980s, some scholars predicted that ICT will play a significant role in the classroom environment in the years to come because of the numerous ways that contemporary technology may enhance education (Salihi, 2015; Bransford et al., 2000). Given the technological change, it appears that intentional efforts are being made, nearly worldwide, to persuade educators to incorporate ICTs and ICT-based activities into the variety of educational resources they use in the classroom (Morris, 2012).

1.1 Use of ICT in teaching science in Albania.

Albania's national education policy includes promoting ICT in the classroom. Albania has started a number of programs to integrate ICT into the educational system. ICT policy, facilities, instructional materials, training of educators, curriculum, along with evaluation are some of the elements that impede the advancement of ICT. Even though preuniversity schools in Albania are provided with access to a large array of innovative science-based ICT resources, there are not much data on how science instructors use these resources in the classroom, what sorts of educational tools they usually employ, or how skilled they are to use these technologies.

As a fundamental professional competency, ICT competencies, are defined in the ISTE Standards (Crompton, 2023) as well as in national level by ASCAP (ASCAP, 2024). In the digital era, digital competencies are increasingly expected of teachers. During the COVID-19 pandemic, when schools were forced to transition to online instruction, ICT competencies—which should be available to all teachers regardless of the subject they teach—proved to be essential. Teachers and students swiftly developed their ICT competencies to enable online instruction.

The study by Prodani et al. (2020) in southeastern Albania examines the availability and use of ICT among students and teachers, including their software knowledge and views on ICT in education. Teacher confidence and attitudes, which influence student interest and understanding are among factors affecting ICT adoption (Prodani et al., 2020). Research by Ibrahim et al. (2024) examines Albanian science teachers' perceptions and utilization of ICTs finding that ICT use is constrained by inadequate infrastructure, limited access to technology, and insufficient training. Prenjasi et al (2011) find that most Albanian teachers believe ICT can enhance science education by providing access to various resources, promoting active and cooperative learning, increasing student interest, improving digital competence, and connecting school science lessons to real-world applications. Insufficient computers and low institutional support, leading to poor usage in science education are among barriers identified in Prodani et al. (2020). Recently, educational institutions are increasingly integrating digital technologies, supported by government investments in ICT infrastructure and teacher training. Increasing ICT access in schools, enhancing teacher training, and promoting positive technology attitudes are encouraged.

The following results of this study show the special elements that science instructors take into consideration when selecting ICT resources to be used in their science lectures. Therefore, insights gathered from this attempt may offer beneficial data that may be applied to evaluate the effectiveness of Albania's ICT initiative in some tiny way.

2. Literature Review

Many studies are published on “ICT and teaching/learning” and have come to the conclusion that technology has a big potential to improve teachers' methodology and students'

accomplishment (Bransford et al., 2000). The use of ICT in science education is examined from the perspective of students' motivation in learning the subject in (Salihi, 2015), and some suggestions for incorporating it into fundamental teaching techniques are offered. In order to ensure a high-quality and efficient technical teaching and learning environment, ICT integration in the classroom has become an ongoing effort for both teachers and students. Teachers are crucial to guaranteeing high-quality education and promoting opportunities for lifelong learning for all. According to the survey reported by Osborne & Hennessy (2003), a lot of science teachers hesitate to use ICT in the classroom.

For current teachers, particularly in science and math, the TPACK (*Technological, Pedagogical, and Content Knowledge*) framework is crucial. Increasing TPACK is associated with raising student achievement. Research shows that integrating technology into instruction has a favorable impact on students' performance in a variety of areas. According to Anwar et al. (2025), science teachers' TPACK scores were considerably raised by systematic training. Although instructors often possess strong topic knowledge, their technical proficiency is still moderate, with more recent teachers exhibiting greater TPACK levels (Akturk & Saka Ozturk, 2019).

2.1 Educational benefits of ICT use in science instruction

Numerous studies have documented the potential advantages of using ICT to teach science. The promotion of cooperation and communication in scientific research endeavors, is one of these possible advantages. In (Gillespie, 2014) it is stated that novel tools can be used in elementary science education to help students get scientific data, engage with resources like pictures and videos, and promote teamwork and communication. Additionally, new technology may help students become more motivated, think more clearly, and improve their ability to comprehend data (Newton & Rogers, 2003).

One of the most popular frameworks for understanding technology adoption in educational contexts is the *Unified Theory of Acceptance and Use of Technology* (UTAUT). It asserts that the main factors influencing behavioral intention and actual usage are four fundamental constructs: (i) performance expectancy, (ii) effort expectancy, (iii) social influence, and (iv) facilitating environments. Researchers like Tolba & Youssef (2022) and Al-zboon et al. (2021) have used UTAUT in science education to demonstrate that science and math teachers typically maintain high, positive attitudes toward technology, seeing it as a crucial tool for improving instructional quality.

In the majority of countries teachers' use of ICT in the classroom focuses on repetitive duties such as automatically retrieving information from the internet (Salihi, 2015). As stated in (Pickersgill, 2003), considering that Internet access is so convenient, teachers can assist pupils in becoming experts at finding knowledge rather than being given facts. The new ICTs have further potential advantages as instruments for improving science instruction and learning in classrooms (Skinner & Preece, 2003). These tools include those for data collection, publication and presentation tools, computer projection technologies, digital recording equipment, computer-controlled microscopes, and multimedia software for simulation (Osborne & Hennessy, 2003). In (Kelleher, 2000) it is stressed that ICT cannot take the place of traditional classroom instruction, but ICTs could be beneficial in science classrooms for a deeper comprehension of scientific concepts and principles as well as for the creation of innovative, successful, engaging, and authentic educational activities.

As reported by (Tayban, 2022), nearly all of teachers unanimously agreed that ICT enabled them to optimize their instruction by giving them additional and up-to-date materials, and they also stated that ICT integration should be employed in teaching and learning.

Teachers also stated that adopting ICT in the classroom offers them more time to attend to the requirements of their students (Tayban, 2022). This suggests that specific demands from learners were not addressed because of a lack of ICT skills and knowledge, as well as administrative obligations and other work that must be accomplished in addition to teaching responsibilities.

New technology can help students learn, but they can also help teachers improve their pedagogical practices. Employing ICT in science instruction makes learning active, constructive, contextual, cooperative, and self-regulated. It also boosts interest, motivation, and engagement in assignments; gives teachers easy access to high-quality, learning-relevant resources (database, web page, videos, text, and demonstration); allows for the visualization and alteration of complex models and three-dimensional images and movement to enhance scientific ideas; supports exploration and experimentation by giving students real-time visual feedback; helps students develop their digital competency; and gives teachers the chance to use tools in creating science lessons (Chakravarty, 2017).

2.2 Constraints affecting ICT adoption in science instruction

The process of incorporating ICT into teaching and learning is intricate and can present several challenges. Barriers such as lack of confidence, competence, and access to resources still exist, despite teachers' great desire to incorporate ICT into the classroom (Bingimlas, 2009). In (BECTA, 2004) barriers are divided into two categories: (i) obstacles at the individual level, such as lack of time, lack of confidence, lack of ICT knowledge and skills, and resistance to change; and (ii) obstacles at the institution level, such as lack of access to resources, insufficient computers or copies of software, and ineffective training in resolving technical issues.

Lack of appropriate training is the most commonly mentioned obstacle in the literature (Schoepp, 2005; Balanskat et al., 2006; Toprakci, 2006). As a result, insufficient teacher competency poses significant obstacles to the incorporation of ICT into the classroom and may lead to resistance to implementing novel teaching methods in science classes. As reported in (BECTA, 2004), teachers' perceptions of how technology would enhance their instruction and students' learning are a crucial component of their attitudes regarding its use.

One of the biggest obstacles to utilizing technology in science education is the absence of technical support. Technical support for schools in resolving hardware and software issues enables teachers to employ ICT in the classroom (Korte & Hüsing, 2007). According to a large number of participants in BECTA's (2004) survey, technical issues could deter them from utilizing ICT in their instruction due to their concern about equipment malfunctions.

3. Methods

Research design: All of the respondents' data was gathered and analyzed using a quantitative methodology in this study. The researchers self-developed a questionnaire before distributing it to the targeted group of respondents. The questionnaire was designed making use of similar studies focusing on systemic barriers in science education (Becta, 2004; Bingimlas, 2009; Schoepp, 2005), previous investigations within the Albanian regional context (Ibrahimi et al., 2024; Prenjasi et al., 2011; Prodani et al., 2020), and frameworks for technology acceptance among science instructors (Al-zboon et al., 2021; Chakravarty, 2017; Tolba & Youssef, 2022). It was designed to particularly address the research objectives about the perceptions of science instructors regarding the use of ICT technologies in South Albanian public secondary and high schools. Every question on the survey was written in Albanian.

Research objectives: The purpose of the study is to provide insights on how teachers feel about using ICT in science classes and how much they really utilize it with their students. Although the majority of the study was exploratory, by interrogating teachers' perceptions of the use of instructional technologies, we also found that the teachers perceive the students' responses to the usage of ICT in the classroom, especially in science classes, as favorable.

Participants and sampling frame: All participants are educators who teach either Mathematics and Physics, or Biology and Chemistry. The participants represent educators teaching across grades 5–9 and 10–12, who were enrolled in a national ICT training program. Both authors of this study served as official trainers, specifically facilitating the sessions conducted in the southern region of the country. Following the conclusion of the training program, the questionnaire distribution was conducted digitally using the trainees' contact phone numbers.

Response Rate: While the exact numerical distribution between urban and rural schools was not recorded, the sample includes teachers from both settings, as these were the environments serviced by the national training program. Out of the 173 teachers contacted, 80 provided completed responses, resulting in a response rate of 46.24%

Demographic summary: Participants in the questionnaire were 80 teachers, made up of 50 female (62.50%) and 30 males (37.50%), who teach in the public secondary schools and in high schools of South Albania (Q1). This group represents a subset of South Albanian science instructors, and while the findings provide significant local insights, the authors acknowledge that the results are specific to this regional group and may not be fully generalizable to the entire national population of science teachers.

Data collection: The data were collected by means of an electronic questionnaire of our own design for the study. Teachers were asked about their opinions on the use of ICT in science education, as well as how much they themselves use it. The link to the Google Form questionnaire was distributed and a week later no more additional responses were accepted. Data collection was supplemented by non-formal discussions held with the trainees during their training sessions to capture broader professional perceptions.

Data analysis: Standard Cronbach's alpha cannot be calculated because the questionnaire is purely descriptive and narrative, lacks Likert-type scales, and includes multiple-response items (Q7, Q13, Q14, Q15) that are incompatible with standard internal consistency formulas. Instead, the study relies on content validity established through the thematic alignment with the literature cited above in the section "*Research Design*" and expert review to ensure the instrument accurately reflects the research objectives

Ethical Consideration: The researchers took into account the ethical considerations necessary for this research. No personal identifying information was asked of participants who answered the questions and selected their responses based on their perceptions. The researchers also ensured that confidentiality, anonymity, and privacy are maintained in data gathering and assessment. Respondents willingly participated anonymously in the research survey. The data collection process was carried out after the respondents were informed of the study's purpose and gave their consent to participate.

4. Results and Discussion

The findings of this study align with the UTAUT framework, specifically illustrating the dominance of performance expectancy as the primary motivator for ICT use among South Albanian science teachers. Our result that 80% of participants use ICT to "*make teaching more effective*" mirrors findings by Akawo et al. (2025) and Tolba & Youssef (2022), where

perceived usefulness was the strongest predictor of behavioral intention. However, a direct parallel can be drawn to Ogegbo (2024), whose study of science teachers also revealed high positive perceptions alongside low actual usage due to a lack of “*facilitating conditions*”. In our sample, the identification of “*deteriorating infrastructure*” (65%) and “*poor internet speed*” (45%) as primary barriers confirms that institutional obstacles often override positive professional attitudes. Furthermore, the disciplinary variation – where Physics teachers report the highest usage (72.50%) for visualization while Mathematics instructors remain more traditional (37.50%) – suggests that ICT adoption is heavily influenced by the perceived “job fit” within specific scientific domains.

Although Albanian science instructors have welcomed the use of ICT-based teaching tools, they have not given up on more conventional approaches. Teachers' ICT integration attempts are obviously influenced by their own confidence levels and their nostalgia for traditional approaches to teaching, in addition to the availability and training components. Albanian educators of preuniversity settings must discuss their ideas and attitudes regarding the use of ICT-based teaching methods in science classes, in addition to the rationale that drives their selection of particular teaching instruments. Although a variety of ICT-based teaching tools are frequently used, teachers most frequently utilize PowerPoint. Teachers still see a lot of value in using instructional tools that are not based on ICT, and many have even mixed the two while teaching science. An investigation into how science instructors combine traditional and ICT-based teaching devices would be an intriguing extension of the existing study.

4.1 Professional profile and the influence of institutional facilitating conditions

QUESTION 2: *Have you participated in workshops and/or attended trainings focused in “ICT use in education”?*

The majority of the surveyed teachers, 68.75% (55/80), have participated in training on the uses of ICT in teaching. Very few teachers have completed advanced courses on internet use (browsing websites, practicing with virtual science labs, using AI, video conferencing, etc.), despite the fact that many have taken introductory training on base Office software or equipment-specific training. On the other hand, also a great number of responses, 72.50% (58/80), to Question 14, make us believe that teachers require “*attending workshops/trainings*” and “*participation in online courses*” ranking these equally as the most efficient way to acquire practical skills in the use of technologies in teaching.

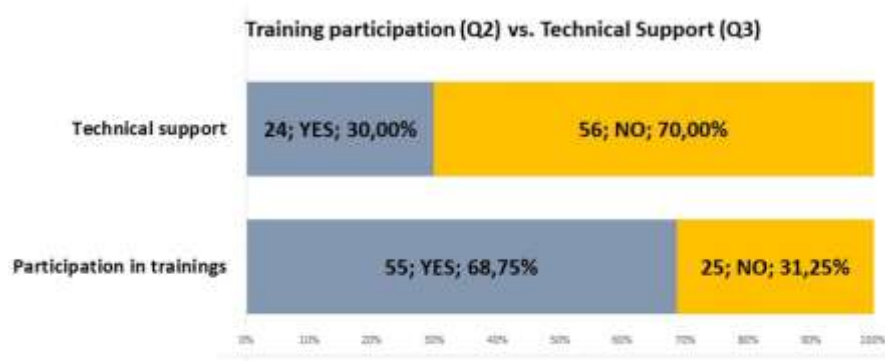


Figure 1 Comparison of Technical Support Availability and Training Participation

QUESTION 3: *Do you have technical support from IT specialists for the maintenance of equipment (computers, printers, internet access, etc.) for teaching purposes?*

Despite the relatively high training participation reported in Q2, the majority of teachers polled, 70% (56/80), have never received technical aid for ICT integration (Q3). As illustrated in Figure 1, a significant structural gap exists between teacher preparation and institutional support, which may influence the effectiveness and frequency of ICT integration in teaching practice. The lack of systematic technical support prevents efficient implementation. It relies primarily on individual teacher initiative, particularly in rural locations where ICT technicians are few. This shortage leads to frustration and decreasing trust in educational tools, as educators struggle with technological challenges. The findings underline the necessity for institutionalized technical support in schools, such as hiring ICT coordinators and establishing helpdesks, to guarantee that the integration of technology is meaningful and effective.

4.2 Disciplinary divergence and patterns of subject-specific ICT utilization

QUESTION 4: How often do you use the computer?

QUESTION 5: How often do you use ICT to support your teaching?

By seeing Q4 and Q5 of the questionnaire as complementary to one another, a more comprehensive picture of the research is produced. Only one respondent—likely the same individual—answers “never” to both questions. Half of the respondents, or 50% (40/80), said they use computers “every day.” This number is nearly equal to the 47.50% (38/80) of Question 5's “often” alternative. The percentage of respondents who say they “always” use the computer as a teaching tool is lower, at 17.50% (14/80). This indicates that 50% of respondents who claim using computers on a daily basis do this for reasons other than supporting their teaching. Additionally, it indicates that using a computer in the classroom is not the only way that technology may be used to support teaching. Q5 implies also other uses, including the prior preparation of instructional materials, looking up extra supplementary materials online, creating tables or questionnaires to track students' attendance or academic progress and, in rare instances (as covered in Q7) for creating electronic tests. The fact that 47.50% (38/80) of the respondents use the computer “often” as a teaching aid is a more realistic impression and a better fit between the options of Q4 and Q5. Analysis of Q4 and Q5 uncovers a significant disparity: educators routinely utilize computers, although ICT is not uniformly incorporated into classroom instruction (visually compared in Figures 2a and 2b). This mismatch presumably indicates the obstacles found subsequently in Q15, specifically issues related to infrastructure and time constraints. The result that 33.75% (27/80) of surveyed teachers use computers “rarely” to support teaching, is related to the following discussion of Q6, according to which teachers of different science disciplines perceive to different degrees the need for the inclusion of ICT in teaching according to the disciplines.

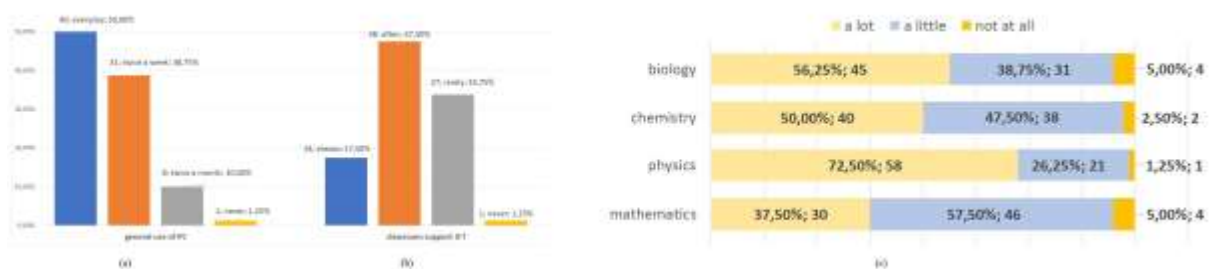


Figure 2 (a) General Use of ICT; (b) Classroom Support; (c) Subject-Specific Application

QUESTION 6: *In your opinion, in teaching of which science is ICT most widely used?*

This inquiry elicited some really intriguing responses. It's interesting to note that just 1.25–5% of the instructors polled believe that “*ICT is not used at all in the teaching of sciences (biology, chemistry, physics, mathematics).*” This perception of those few respondents is related to the lack of ICT equipment in the schools where they teach, which prevents them from using ICT in their day-to-day teaching practice. The majority of respondents, 72.50% (58/80), think that “*ICT is used very widely in the teaching of physics*” as shown in Figure 2c. This is strongly related to the fact that physics is an experimental science, and preparing for physics experiments is time-consuming, and frequently calls for costly equipment. Virtual laboratories are an excellent substitute for conducting physics experiments in a visual, screen-based, interactive manner. The second most wide usage of ICT is biology teaching, ranked by 56.25% (45/80) of the teachers polled. This is due to the fact that biology as a science is closely linked to field observations of nature, and the teaching of this subject in the closed environment of a classroom presents the need for increased use of visual aids that ensure a more accurate and faster understanding of the teaching material by the student. Teachers' perceptions of the usage of ICT in chemistry instruction are nearly identical to those of traditional methods: 50% think it is “*used a lot,*” and 47.50% think it is “*used a little.*” Teachers view ICT as particularly valuable in subjects that benefit from visualization and simulation of phenomena. Lastly, compared to the three disciplines previously stated, educators believe that the use of technology in mathematics instruction is less essential. 57.50% (46/80) of respondents, think that ICT is “*used a little*” in math instruction. We believe this perception is explained with the fact that, despite their abundance, computer software that can be used to teach mathematical ideas are typically not free and require for slightly more sophisticated computer skills from teachers in order to use them with students in the classroom.

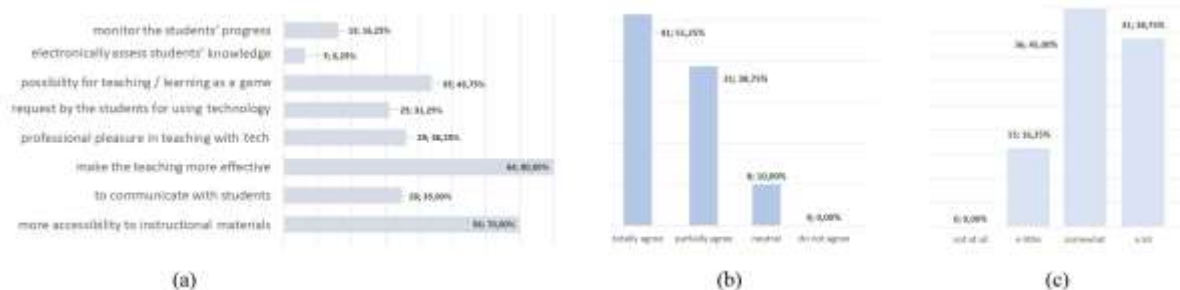
4.3 Performance expectancy: Teacher standpoints and perceived instructional efficacy

Figure 3 (a) Internal Motivations; (b) Teacher Standpoints; (c) Perceived Efficacy. (in figure 3a, Total exceeds 100% as respondents could select multiple options).

QUESTION 7: *Which do you think motivates you more to use ICT in your teaching? (select 1 – 5 choices)*

The primary professional drivers for ICT integration, which align with the UTAUT construct of performance expectancy, are ranked in Figure 3a. The fact that the majority of respondents, 80% (64/80) identified the prospective of ICT to “*make the teaching more effective*” as the primary reason for using it in their lectures is exactly what we expected. They have observed that when technology is utilized as an adjunct to conventional methodological approaches, students' engagement and interaction are improved. Given that this perspective is expressed by science teachers who frequently struggle to explain complex ideas in physics, mathematics, chemistry, and biology, this is a very significant finding. The

respondents, 70% (56/80), highlighted using ICT “*in order to expand the accessibility of instructional materials for students*” as the second most significant justification. This is explained by the fact that often the teachers consider the textbook information as incomplete regarding specific topics, and ICT is a tool that offers additional details in a more attractive and comprehensive way. It results by the responses that ICT is used by the teachers in rare cases, 16.25% (13/80), to “*monitor the students’ progress during the year*” and even more rarely, 6.25% (5/80), to “*electronically assess students’ knowledge*”. The educators prefer to evaluate students’ understanding of the concepts in the traditional way: short and direct question-answer sessions during the classes and final written tests. Of course, these assessment methods are also imposed by the lack of technological infrastructure in schools, students’ computer skills, and more importantly, teachers’ insufficient skills to prepare computer tests on certain natural science topics. Teachers themselves, 72.50% (58/80), equally point out “*attending workshops/trainings*” and “*participation in online courses*” in Q14 as the most efficient ways to fill their need for acquiring practical skills in the use of technologies in teaching. Although the survey was conducted anonymously, we logically connect the amount of 43.75% (35/80) of respondents who selected the alternative “*possibility for teaching/learning in a game environment*” with the fact that the majority of teachers surveyed teach in Secondary Education. The least motivating factor for the use of ICT in teaching, among other alternatives, was “*the request by students for using technology*” with 31.25% (25/80) of the responses. Considering as indisputable the fact that ICT increases the efficiency of teaching, we believe that this number of responses is explained by the limited information that students may have about the existence of a large number of ICT hardware and software that can be used to support science teaching. Finally, the alternatives “*to communicate with students*” and “*professional joy in teaching with technology*” are rated almost equally motivating to integrate ICT in science education, 35% (28/80) and 36.25 (29/80), respectively. The results indicate that educators view ICT mainly as a pedagogical instrument to enhance teaching efficacy, rather than as a medium for communication or a response to student demand. This explanation is closely aligned with Q9, in which the majority of instructors indicated that ICT enhances teaching effectiveness to a significant extent, 83.75% (67/80). This affirms a persistent belief that ICT enhances educational quality.

QUESTION 8: Which is your standpoint regarding the technology use in teaching of sciences?

Question 8 seeks to determine how teachers feel about using technology in the classroom. The fact that 38,75% (31/80) of respondents who selected “*partially agree*” is related to the fact that all of them are teachers of various natural science disciplines and have differing views on which science the ICT is most commonly used for teaching, as covered in Q6. Teachers’ positive standpoint (90% agreement) acts as a dominant predictor of their intention to use these tools despite structural challenges.

QUESTION 9: How much do you think ICT improves the effectiveness of teaching?

Considering Q8 and Q12, 38.75% (31/80) of the “*partially agree*” option selected in the responses to Q8 may be explained by the result of 45% (36/80) of the “*somewhat*” alternative selected in Q9. Regarding the extent to which the use of ICT in the classroom has improved teaching effectiveness, 38.75% (31/80) of respondents chose the option “*a lot*” as the second most important. The responses to Q7, which show that the overwhelming majority of responses, 80% (64/80), are more motivated to use technology in the classroom to “*make teaching more efficient*,” further confirm this fact. In combination of responses given in Q9, 67 of the 80 teachers polled believe that ICT usage enhances instruction “*a lot*” and “*somewhat*.”

4.4 Effort Expectancy and Perceptions of Instructional Outcomes: Workload vs. Engagement



Figure 4 Impact on (a) Teacher Effort; and (b) Time

QUESTION 10: Do you think that the use of technology in teaching will be excessive?

QUESTION 11: How technology usage impacts the time you spend for various aspects of teaching process?

The aforementioned Questions 10 and 11, are complementary to one another and seek to determine the degree to which teachers view the use of technology in science instruction as an excessive workload in terms of extra fatigue in addition to other challenges of the job (Q10) and in terms of time spent creating instructional materials (Q11). Educators pay a pedagogical cost in terms of increased preparation time and fatigue (Figure 4a). The phrase “*various aspects of teaching process*” in Q11 includes not only the direct concrete use of ICT in the classroom but also other activities such as the preparation of didactic materials, searching for supplementary materials online, filling up forms for the official database of school, creating tables or surveys to track students' attendance and academic progress, setting up electronic tests, etc. We note that a small number of the surveyed teachers, 7.50% (6/80), consider the use of ICT as “*much excessive*” (Q10), and also a small number of them, 3.75% (3/80), think that “*it saves a lot of time*” (Q11). The explanation for these percentages is related to the computer skills of teachers: the use of technology is considered “*much excessive*” by teachers with limited computer skills, and, conversely, teachers with advanced computer skills think that the use of ICT “*saves them a lot of time.*” The responses to both Q10 and Q11, are explained by what really happens during this process. Initially it is a bit tiring to prepare the teaching materials: an equal number of respondents 33.75% (27/80) have chosen “*a little excessive*” and “*tolerable excessive*” (Q10). Initially it takes time: 38.75% (31/80) of the polled teachers “*spend more time*” to prepare the teaching materials (Q11). Once you have prepared them, their use maybe “*does not save a lot of time*” as 43.75% (35/80) report, or “*save a little time*” as 22.50% (18/80) of surveyed teachers report (Q11), but it only needs minor improvements over time, and above all, using ICT makes teaching science more effective as discussed in Q7. While of course the use of ready-made open access teaching materials that can be found online free of charge, saves a lot of time. Teachers' perspective regarding workload show that ICT integration is still perceived as time-consuming, which may discourage frequent implementation in classroom practice. This perception aligns strongly with Q15, where 53.75% (43/80) identified “*insufficient time to integrate ICT*” as a major barrier.

QUESTION 12: In your perception, how do students react towards the use of technology in science teaching?

Question 12 seeks to determine how teachers view students' responses about using technology in the classroom. The majority of respondents, 76.25% (61/80), believe that their students' responses to ICT in the classroom are “*positive*”. Additionally, 51.25% (41/80) of instructors “*totally agree*” with this statement (Q8). Remarkably, none of the teachers surveyed think that students react “*negatively*” (Q12), and also none of them chose “*do not agree*” regarding the use of ICT as an additional auxiliary tool in teaching sciences (Q8). These two questions demonstrate strong attitudinal alignment: teachers perceive positive student engagement and, teachers themselves support ICT integration. Hence, attitudes are not the main barrier to ICT adoption. In relation to Q8 and Q12, none of the instructors polled believe that using ICT “*does not improve at all*” the effectiveness of teaching science. It can be noted that all three questions (Q12 / Q8 / Q9) are highly aligned: perceived student positivity / positive attitude / perceived effectiveness.

QUESTION 13: *In which aspect do you think the student benefits more by using technology in teaching? (select 1 – 3 choices)*

According to 85% of the instructors polled (68/80), students gain the most from using technology in the classroom when it comes to “*carrying out group projects*.” The following benefits are perceived by roughly the same percentage of teachers: “*presenting homework*,” 43.75% (35/80); “*carrying out laboratory practices*,” 46.25% (38/80); and “*collaborating with other students*,” 45% (36/80). As expected, only 10% (8/80) of educators think that learners use technology to “*test their knowledge on their own*.” This is further explained by the difficulty in finding online assessment tools in Albanian that are completely compliant with the particular natural science curriculum. This perception by teachers is likewise in line with the low percentage, 6.25% (5/80), of choosing the “*electronically assess students' knowledge*” alternative discussed for Q7. Teachers associate ICT more with interactive and collaborative pedagogy rather than with *assessment* or *testing* purposes.

4.5 Systemic Barriers and Strategic Pathways for Professional Competency Development

QUESTION 14: *Which do you consider as more effective to gain skills in using instructional technologies? (select 1 – 3 choices)*

A great number of responses, 72.50% (58/80), equally rank the alternatives “*attending workshops/trainings*” and “*participation in online courses*” as the most efficient ways to acquire practical skills in the use of technologies in teaching (Figure 5a). This is a significant finding, as teachers themselves highlight the need for continuous training with regard to the usage of ICT in teaching even though part of them, 68.75% (55/80), report having attended such workshops previously (Q3). Teachers rank nearly equally two other ways to gain computer skills: “*discussing with colleagues*” is ranked second by 52.50% of responses, and “*consulting with IT specialists*” is ranked third most effective by 50% of responses. Only 11.25% (9/80) of the teachers consider “*reading books and tutorials*” as the less effective way for gaining computer skills. This suggests teachers prefer interactive and collaborative learning environments for developing digital competencies.

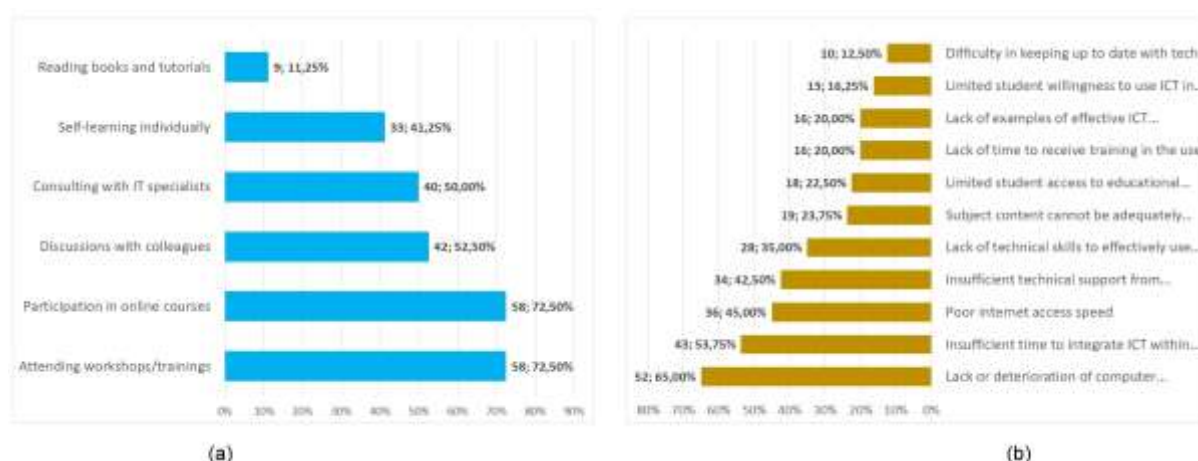


Figure 5 (a) Pathways for Skill Acquisition; and (b) Systemic Barriers to Integration. (In figure 5a and 5b, Total exceeds 100% as respondents could select multiple options).

QUESTION 15: Which of the factors do you consider to be greatest barrier to using ICT in your teaching? (choose 1–5 alternatives.)

The findings from responses of this question, reveal that the primary obstacles to ICT integration in education (ranked in Figure 5b) are institutional and infrastructural, rather than instructional or motivating. The predominant difficulty mentioned was the “*lack or deterioration of computer infrastructure in the school*”, 65% (52/80), indicating that several institutions lack sufficient or operational technical resources. “*Poor internet access speed*” (45%), closely linked to infrastructural difficulties, further hinders the effective utilization of electronic devices, online platforms, and audiovisual assets. A “*lack of adequate technical support*”, 42.5% (34/80), was also recognized as a significant problem, indicating that educators feel unsupported during technological challenges, which undermines their confidence in using ICT. The second most substantial obstacle was “*inadequate time for the integration of ICT*” into classes (53.75%). This indicates curriculum demands, substantial teaching responsibilities, and restricted adaptability in instructional timetables. In contrast, limitations related to teacher competency, reported by 35% of responses, and perceived student low-willingness, reported by 16.25% of responses, suggest that teachers generally do not consider attitudes or student motivation as the key impediment, confirming the teachers’ perception of positive student attitudes identified in Q12.

5. Conclusion

The outcomes of this study reveal a strong and continuous positive orientation toward ICT integration among science teachers. The majority of respondents regard ICT as a beneficial tool for enhancing teaching quality, expanding students’ access to learning materials, and fostering engagement. Students are also perceived by their teachers as reacting positively to ICT-supported instruction, validating the pedagogical value assigned to digital instruments. The study highlights as the most notable barriers the poor infrastructure, limited technical support, and insufficient time for effective classroom integration. Importantly, perceived opposition from students or incompatibility with topic matter does not appear to be a major worry for teachers, showing that barriers are mostly institutional rather than pedagogical.

This research concludes that science teachers in South Albania are professionally driven and philosophically aligned with ICT-enhanced education. The strong attitudinal alignment observed confirms that the primary obstacles to adoption are structural and institutional,

rather than pedagogical or connected to teacher resistance. As evidenced in both our findings and literature, sustainable ICT integration requires the strengthening of “facilitating conditions” specifically providing functioning computer labs, reliable internet, and dedicated technical support. While this study focused on a specific regional sample and results may not be fully generalizable to the entire nation, it offers a theoretically grounded baseline for future large-scale investigations into science teacher digital proficiency.

6. Recommendations

Based on above findings, recommendations can be made at the *institutional, professional, and policy* levels to improve ICT integration in science education. *First*, funding for facilities should be considered with more priority. Functional equipment, reliable internet access, and proper maintenance should all be provided by schools. *Second*, technical assistance needs to be strengthened. Teachers experience stress when further technical assistance is not available. Problems can be significantly reduced by establishing unified technical assistance services or ICT support personnel. *Third*, professional development should be concentrated on practice and should enlarge. As teachers prefer workshops and online courses training sessions should focus on subject-specific applications. The objective is to create ICT platforms that are especially appropriate for science education and to improve teaching strategies. Finally, institutions should support discipline-specific ICT frameworks, particularly in the sciences where visualization and simulations can significantly improve conceptual understanding. For ICT integration to be sustainable, training, infrastructure, and curriculum requirements must be aligned.

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APPENDIX – Full Research Questionnaire and Comprehensive Descriptive Results

Table 1 Participant Demographics and Institutional Support Environment

		Frequency (n)	Percentage (%)
Q1	Your gender?		
	Female	50	62.50 %
	Male	30	37.50 %
Q2	Have you participated and/or attended trainings focused in “ICT use in education”?		
	Yes	55	68.75 %
	No	25	31.25 %
Q3	Do you have technical support for the maintenance of equipment for teaching purposes?		
	Yes	24	30.00 %
	No	56	70.00 %

Table 2 Patterns of ICT Utilization and Subject-Specific Application

		Frequency (n)	Percentage (%)
Q4	How often do you use the computer?		
	Every day	40	50.00 %
	Once or twice a week	31	38.75 %
	Once or twice a month	8	10.00 %
	Never	1	1.25 %
Q5	How often do you use ICT to support your teaching?		
	Always	14	17.50 %
	Often	38	47.50 %
	Rarely	27	33.75 %
	Never	1	1.25 %

Q6 In your opinion, in teaching of which science is ICT most widely used?				
Mathematics	A lot	30	37.50 %	
	A little	46	57.50 %	
	Not at all	4	5.00 %	
Physics	A lot	58	72.50 %	
	A little	21	26.25 %	
	Not at all	1	1.25 %	
Chemistry	A lot	40	50.00 %	
	A little	38	47.50 %	
	Not at all	2	2.50 %	
Biology	A lot	45	56.25 %	
	A little	31	38.75 %	
	Not at all	4	5.00 %	

Table 3 Teacher Standpoints, Internal Motivations, and Perceived Efficacy. (For Q7 - *Motivating factors*, respondents were permitted to select more than one alternative; consequently, the sum of percentages for this question exceeds 100%)

		Frequency (n)	Percentage (%)
Q7 What motivates you most to use ICT in your teaching practice? (select 1-5 alternatives)			
To make teaching more effective		64	80.00 %
To increase students' access in learning materials		56	70.00 %
Possibility for teaching in a game environment		35	43.75 %
Professional joy in teaching with technology		29	36.25 %
To communicate with students		28	35.00 %
The request by students for using technology		25	31.25 %
Monitor the students' achievement during the year		13	16.25 %
For electronically testing the students' preparation		5	6.25 %
Q8 Which is your standpoint regarding the ICT use in teaching of sciences?			

Totally agree	41	51.25 %
Partially agree	31	38.75 %
Neutral	8	10.00 %
Do not agree	0	0.00 %
Q9 How much do you think ICT improves the effectiveness of teaching?		
A lot	31	38.75 %
Somewhat	36	45.00 %
A little	13	16.25 %
Not at all	0	0.00 %

Table 4 Impact on Professional Workload and Perceptions of Student Outcomes. (For Q13 - *Student benefits*, respondents could choose multiple options; the total percentage for this item exceeds 100%).

	Frequency (n)	Percentage (%)
Q10 Do you think that the use of technology in teaching will be excessive / fatigue for you?		
Much excessive	6	7.50 %
Tolerable excessive	27	33.75 %
A little excessive	27	33.75 %
No excessive at all	20	25.00 %
Q11 How the using of ICT impacts the time you spend for various aspects of teaching process?		
Does not make any difference	35	43.75 %
I spend more time	31	38.75 %
It saves me a little time	18	22.50 %
It saves me a lot of time	3	3.75 %
Q12 In your perception, how do students react towards the use of ICT in science teaching?		
Positively	61	76.25 %
Neutral	19	23.75 %
Negatively	0	0.00 %

Q13 In which aspect student benefits more by using ICT? (select 1-3 alternatives)		
Group projects	68	85.00 %
Laboratory practices	37	46.25 %
Class collaboration	36	45.00 %
Homework presentation	35	43.75 %
Knowledge self-testing	8	10.00 %

Table 5 Pathways for Skill Acquisition and Systemic Barriers to Integration (Both Q14 - *Ways to gain skills* and Q15 - *Greatest barriers*, allowed for multiple selections per respondent. Total percentages for these items will sum to more than 100%).

	Frequency (n)	Percentage (%)
Q14 Which do you consider as most effective way to gain skills in using ICT? (select 1-3 alternatives)		
Attending workshops/trainings	58	72.50 %
Participation in online courses	58	72.50 %
Discussions with colleagues	42	52.50 %
Consulting with IT specialists	40	50.00 %
Self-learning individually	33	41.25 %
Reading books and tutorials	9	11.25 %
Q15 Which do you consider to be greatest barrier to using ICT in teaching? (select 1-5 alternatives)		
Lack or deterioration of computer infrastructure in the school	52	65.00%
Insufficient time to integrate ICT within classroom instruction	43	53.75%
Poor internet access speed	36	45.00%
Insufficient technical support from auxiliary staff	34	42.50%
Lack of technical skills to effectively use technology	28	35.00%
Subject content cannot be adequately explained through ICT	19	23.75%
Limited student access to educational technology	18	22.50%
Lack of time to receive training in the use of technology	16	20.00%
Lack of examples of effective ICT integration practices	16	20.00%

Limited student willingness to use ICT in the learning process	13	16.25%
Difficulty in keeping up to date with technology developments	10	12.50%
