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An investigation of technology-rich lesson plans: Science teachers' views on technology integration

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Numerous studies have extensively explored technology integration in instructional processes, covering learning outcomes, barriers, administrative support, and teachers' technological proficiency. However, limited research has specifically investigated teachers' perceptions of technology-rich instructional methods. This study involved a collaborative effort between a researcher and three science educators to develop technology-rich lesson plans. It aimed to investigate science teachers' perspectives on technology integration, encompassing aspects such as professional satisfaction, preparation time, provision of pre-designed lesson plans and materials, and preferences for technology-rich teaching approaches across distinct demographic variables. Utilizing a design-based research approach with a mixed-method design, this study employed a sequential triangulation model. The quantitative phase engaged sixty-three science teachers, complemented by a qualitative phase with three participants. Data collection methods included the Technology-rich Lesson Plan Evaluation Survey and semi-structured interviews. Teachers assessed three lesson plans for instructional appropriateness and technology integration dimensions. The Chi-Square test analyzed variations in teachers' opinions towards technology integration based on demographic characteristics such as gender, work experience, and self-reported computer competency. While not statistically significant, the results suggest that pre-designed technology-rich lesson plans positively impact professional satisfaction and reduce lesson preparation time. Teachers emphasized the necessity of providing such pre-designed lesson plans and materials for all learning outcomes, indicating a clear intention towards technology-rich teaching methodologies over traditional.

Introduction

The pursuit of improved learning and teaching has remained a pivotal concern for humanity over epochs, facilitating the transmission of accumulated knowledge to successive generations, culminating in our current scientific and technological advancements. The advent

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of 20th-century technologies has intensified societies' efforts to teach better. The proliferation of computers and diverse audiovisual tools has markedly increased their integration within educational settings (Reiser, 2001; Tanel, 2020). In the 21st century, societal needs have catalyzed shifts in expected competencies, significantly impacting both student and educator dynamics (Binkley et al., 2012; Chen, 2010; Moursund & Bielefeldt, 1999). This transformation necessitated corresponding changes in pedagogical approaches, leading to investments in technological infrastructure, the inception of educational portals, and strategic pre-service and in-service training initiatives (Kavak et al., 2016). Nonetheless, these endeavors failed to foster widespread technology integration among educators (Bauer & Kenton, 2005; Çiftçi et al., 2013), underlining the imperative for educators' knowledge, skills, and competences (Mishra & Koehler, 2006). This prompted both international and local initiatives: the International Society for Technology in Education (ISTE) delineated essential standards for educators (ISTE, 2021), complemented by UNESCO's ICT Competency Framework for Teachers 2018 report, designed to equip educators in nurturing 21st-century digital citizens aligned with the 2030 Agenda for Sustainable Development (UNESCO, 2018).

In addition to organizational efforts, recent research has sought to construct frameworks that aid teachers in more effective technology integration. While studies in the early 2000s primarily highlighted challenges and obstacles, notably technical infrastructure issues, subsequent research shifted toward assessing teachers' competencies. Numerous studies have addressed barriers to teachers' technology integration (Ertmer, 1999; Hew & Brush, 2007; Instefjord & Munthe, 2017). Initially, external barriers such as technology access and support predominated; however, later investigations delved into internal barriers encompassing teachers' confidence, perceived value, self-efficacy, and beliefs (Hur et al., 2016; Taimalu & Luik, 2019) after recognizing that mere hardware and software accessibility does not ensure successful integration (Cheng & Xie, 2018). Consequently, studies have explored different models such as TPACK (Mishra & Koehler, 2006), examining them alongside TAM and self-efficacy (Davis, 1989; Scherer et al., 2019; Cheng & Xie, 2018). For instance, TAM has been pivotal in uncovering teachers' technology acceptance perspectives (Mailizar et al., 2021; Scherer et al., 2020), providing pedagogical underpinnings for effective technology integration in educational contexts. A myriad of studies have focused on in-service and pre-service teachers (Rosenberg & Koehler, 2015; Zhang & Tang, 2021). However, technology integration into teaching remains complex (Backfisch et al., 2021), involves diverse challenges (Weisberger et al., 2021), and changing teachers' perceptions remains a significant barrier (Vongkulluksn et al., 2018).

A review of the TPACK literature (Baran & Canbazoğlu Bilici, 2015; Voogt et al., 2013) revealed that most studies focused on assessing in-service and pre-service teachers' TPACK competency and/or technology literacy. Many studies have also focused on teachers' perceptions of technology and teaching with technology. A significant critique of these studies is their reliance on self-assessment surveys to determine teachers' TPACK levels (Abbitt, 2011; Voogt et al., 2013). It is worth noting that during this period, studies approached TPACK as a general framework, suggesting a need for more subject-specific investigations (Lee et al., 2022; Wu, 2013). Subsequently, research explored teachers' perceptions of technology following subject-specific professional development, incorporating technology knowledge (Alemdag, et al., 2020; Tondeur et al., 2020). However, merely developing technological knowledge does not ensure successful technology integration, as effective integration transcends mere knowledge and skills (Wang et al., 2019).

As mentioned earlier, early research primarily focused on understanding teachers' barriers and resistance to integrating technology into learning environments (Ertmer, 1999; Howard, 2013). Various studies have addressed issues ranging from the lack of technological infrastructure (Norris et al., 2003) to teachers' unfavorable perceptions regarding teaching with technology (Vannatta & Nancy, 2004). With improved technology accessibility and infrastructure, attention has shifted towards supporting teachers (Lowther et al., 2008). Teachers' professional knowledge and skills are crucial for successful technology integration (Baumert et al., 2010). Numerous studies have aimed to support teachers' TPACK development, proposing diverse strategies and models (Lee et al., 2022). Along with requisite knowledge and skills, teachers' beliefs and perceptions about technology integration are vital. Early studies investigated teachers' attitudes (Kadel, 2005), views (Levin & Wadmany, 2008), concerns (Liu & Huang, 2005), self-efficacy (Wang, Ertmer, & Newby, 2004), and other factors (Inan & Lowther, 2020) regarding technology integration. However, many of these studies explored teachers' general views without specific hands-on experience. Few studies have delved into teachers' personal experiences with technology integration (e.g., Khan et al., 2016) or their views on technology-rich teaching processes.

Improving teaching through technology poses challenges (Reid, 2017), requiring significant effort for comprehensive integration. In addition to knowledge and skills, teachers should also have positive attitudes toward technology integration (Kadel, 2005). "Evidence suggests teachers' beliefs about and readiness for technology integration have the strongest direct relationship with integration" (Barton & Dexter, 2020, p. 90). Strategies that encourage positive attitudes and beliefs among teachers are crucial (Farjon et al., 2019). One strategy involves exposing teachers to examples of technology-integrated instructional practices, offering them a tangible understanding. Therefore, encouraging teachers to believe in their ability to succeed in technology integration is crucial (Christ et al., 2019). Providing teachers with information about the technology integration process, which necessitates a shift in their teaching, fosters a more positive outlook on the change process. The Diffusion of Innovation theory (DOI) and the Technology Acceptance Model (TAM) are the most frequently referenced theoretical sources to explain this complex change process (Al-Rahmi et al., 2019). Both suggest that various favorable characteristics (e.g., perceived usefulness, relative advantage, perceived ease of use, and complexity) are effective in the adoption of innovations (Li et al., 2011).

According to the diffusion of innovation theory (Rogers, 2003), individuals first encounter an innovation, become aware of its existence, and then seek to understand its functionality (Çakıroğlu, 2018). Subsequently, in the persuasion stage, individuals develop attitudes toward the innovation to resolve uncertainties, shaping their decision on whether to adopt or reject it. Understanding this intention is pivotal within the TAM framework for the technology adoption process (Hu et al., 2003). Various factors contribute to uncovering this intention, positively impacting teachers' willingness to employ technological innovations in teaching practices. Although perceived ease of use and usefulness were central in the original TAM model (Davis, 1989), later studies integrated additional variables within the technology acceptance construct (Scherer et al., 2020). For instance, Al-Rahmi et al. (2019) emphasized complexity, the relative advantage, and perceived enjoyment as influential factors on perceived usefulness. Usefulness in the educational context can have various aspects such as enhancing learning quality, improving professional experience, optimizing teaching, and reducing preparation time.

This study aims to clarify the phase of understanding technological innovation within the DOI for teachers' technology integration, providing insights into technology-rich instructional methods. By exploring technology-rich lesson plans, teachers are expected to grasp the perceived usefulness associated with technology. This study posits that time-saving and professional satisfaction implicitly strengthen perceived usefulness (Al-Rahmi et al., 2019), influencing teachers' choices regarding preferring technology-rich teaching methods. While prevailing research primarily emphasizes learner satisfaction (Tjørve et al., 2010) alongside academic success, motivation, and engagement, another vital stakeholder in the teaching-learning process, remains limited (Cheok & Wong, 2015; Dorner & Kumar, 2017). Among many other factors, teachers' professional satisfaction is one of the important factors in terms of adopting technology integration. Teaching quality significantly influences both student satisfaction and academic performance (Ko & Chung, 2014). Therefore, procuring insights into teachers' professional satisfaction throughout the technology integration process holds paramount importance.

Crompton and Sykora (2021) highlight the lack of empirical evidence on educators' clarity in technology integration, emphasizing the ongoing need to explore varied perspectives in this context. This study aims to uncover how teachers approach technology integration with regard to meticulously prepared, technology-rich lesson plans. Existing studies generally assess teachers' opinions, attitudes, and confidence in technology use within the teaching process without concrete examples (Martin, 2015). In contrast, this study delves into teachers' views by examining technology-rich lesson plans. Teachers' perceived (Inan & Lowther, 2010; Xie & Hawk, 2017) and pedagogical (Ertmer & Ottenbreit-Leftwich, 2010) beliefs regarding technology integration are essential. Fostering positive teacher beliefs regarding the role of technology in teaching (Cheok et al., 2016; Ertmer, 2005) can significantly enhance their utilization of technology (Tondeur et al., 2012), particularly when complemented by practical examples (Webb, 2005). Technology-rich examples contribute to teachers' comprehension of the value of technology in classroom instruction (Salinas, 2008). Despite prior endeavors, significant research gaps persist in comprehending the multidimensional aspects of teachers' technology integration. This study distinctly concentrates on teachers' perspectives when supplied with pre-prepared, technology-rich lesson plans and accompanying materials.

Purpose of the Study

This study aimed to gauge teachers' perspectives on technology-rich lesson plans. We analyzed teacher insights encompassing the instructional and technological aspects of these plans. In the context of technology integration, teachers expressed opinions on professional satisfaction, preparation time for teaching, availability of technology-rich lesson plans for all learning outcomes, and their intention to shift from traditional to technology-rich teaching. In addition, we examined significant correlations between teachers' demographic profiles and their views on technology integration.

Method

This study employed a mixed-methods approach, utilizing a sequential triangulation design model. The purpose of this study was to elaborate the quantitative findings with qualitative data, adhering to Creswell's model (2007). As outlined by Morse's classification (1991), our methodology aligns with a sequential triangulation design, where the quantitative phase is given higher significance and priority (see Fig. 1).

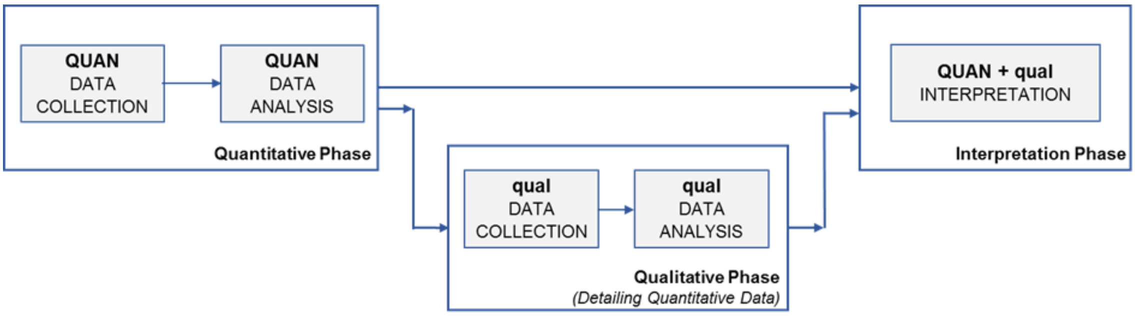

Figure 1. Design of the Study

Research Group

The research group for this study was selected using a convenient sampling method, a form of non-random sampling where data is collected from the subjects that the researcher can easily reach (Johnson & Christensen, 2014). A total of 63 science teachers participated, with 76.2% (n=48) being female and 23.8% (n=15) male, as indicated in Table 1. Regarding professional experience, 57.1% (n=36) were categorized as highly experienced (with 11 years or more in the field) and 42.9% (n=27) as less experienced (below 11 years). Participants self-reported their computer competencies, with 84.1% (n=53) considering themselves advanced and 15.9% (n=10) as intermediate.

Table 1. Demographic Information about the Participants

Demographics	Information	f	%
Gender	Female	48	76.2
	Male	15	23.8
Work experience	Less experienced	27	42.9
	Very Experienced	36	57.1
Self-reported computer competence	Intermediate	10	15.9
	Advanced	53	84.1
	Total	63	100

Data Collection Instruments

Two data collection instruments were employed. First, a 5-point Likert scale called the Technology-rich Lesson Plan Evaluation Survey (TLPES) was utilized for quantitative data collection. Comprising two main sections, the first gathered participant demographic information: gender, work experience, and self-reported computer competencies. The second section assessed lesson plans across two sub-dimensions. One focused on instructional appropriateness (8 items), emphasizing the plans' impact on students and learning, while the other delved into technology integration (9 items). The latter uncovered teachers' perspectives on professional satisfaction, preparation time, availability of pre-made lesson plans, and preference for technology-enriched teaching processes.

In developing the Technology-rich Lesson Plan Evaluation Survey (TLPES), the survey development process proposed by Büyüköztürk et al. (2019) was followed. In the first stage, the problem context and relevant keywords were identified to align with the survey's purpose. Next, a literature review was conducted on the identified problem and keywords. Based on the findings, an initial item pool was created to guide the data collection tool in the second stage. The researcher and a field expert collaboratively reviewed and finalized the items for the draft form. In the third stage, these items were formatted with response options of "appropriate / not appropriate / other" to facilitate expert evaluation. This draft was then sent to seven experts in instructional technology and science education for review. Following an analysis of expert feedback and agreement levels, revisions were made to certain items; for example, statements containing multiple actions in one item were separated for clarity. Based on expert recommendations, a 5-point Likert scale was adopted for item responses. In the fourth stage, the revised data collection tool was piloted by three science teachers. Feedback from these teachers on the comprehensibility, appropriateness for the target audience, and the overall structure led to final adjustments, and the TLPES was prepared for formal data collection. The development process of TLPES is summarized in Fig. 2 below.

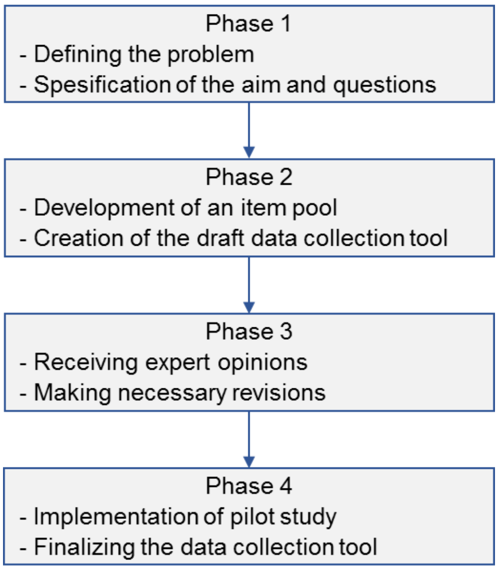

Figure 2. The process of development of data collection tools

In this study, interviews with volunteer participant teachers were planned to gather qualitative data that could support the quantitative findings from the main study group or highlight any missing or weak areas. For this purpose, the semi-structured interviews utilized the Technology-rich Lesson Plans Interview Form (TLPIF) as a secondary data collection tool. A total of 14 questions were designed, focusing on three key areas: the teaching process of the lesson plan (5 questions), the integration of technology in the lesson plan (6 questions), and the contribution of the materials in the lesson plan (3 questions). These questions were reviewed by a field expert specializing in instructional technology, and the interview form was finalized based on their feedback.

Data Analysis

Due to the considerable time needed for a comprehensive analysis of a lesson plan, examining three separate plans by each teacher was not feasible. Consequently, 21 teachers analyzed one lesson plan each, contributing to a total of 63 completed TLPES surveys. The responses to the survey are presented with frequency and percentage distributions, while qualitative data from semi-structured interviews were subjected to content analysis.

Analyses were based on demographic variables such as gender, work experience, and self-reported computer competence. Chi-Square tests were employed to examine differences in teachers' opinions on technology integration across these characteristics. Fisher's Exact test results were reported because the expected values in the chi-square tables were less than 5 in most cases (more than 20% in one cell). When the expected value is less than 5 in Chi-Square tests, combining categories (columns) is recommended (Büyüköztürk, 2023). Consequently, 'Strongly disagree' and 'Disagree' responses were recoded as negative opinions (Disagree), while 'Agree' and 'Strongly agree' were recoded as positive opinions (Agree)."

Design and Development of Technology-rich Instructional Processes

The researcher assumed the role of instructional technologist, performing the development of lesson plans from the initial needs analysis to the final stages, excluding implementation, in collaboration with three science teachers. Initially, a needs analysis was conducted with seven science teachers to identify areas for improvement in learning outcomes. Based on this analysis, the focus was directed towards the 'Force, Work, and Energy Relationship' topic within the seventh-grade science curriculum, specifically targeting two learning outcomes. These outcomes, 'Understanding the relationship between physically applied force and work done' and 'Differentiating between kinetic and potential energy related to work', were recommended to be covered in six lesson hours by the Ministry of National Education. Accordingly, three lesson plans, each two hours, were developed.

After determining the learning outcomes, preparations for lesson plan development began with three science teachers conducting an instructional design analysis for every two lesson hours. Simultaneously, an instructional material pool was created. Each lesson plan was structured around nine events of instruction (attention, objective setting, recall of prior learning, content presentation, guidance, practice, feedback, and performance assessment) (Gagné, 1985). Subsequently, the developed lesson plans underwent quality control by science teachers, an instructional technology expert, and two professors from the science education department. Incorporated feedback was used to update and finalize the plans in collaboration with a science teacher. Fig. 3 illustrates the process from the needs analysis to the finalization of the lesson plans.

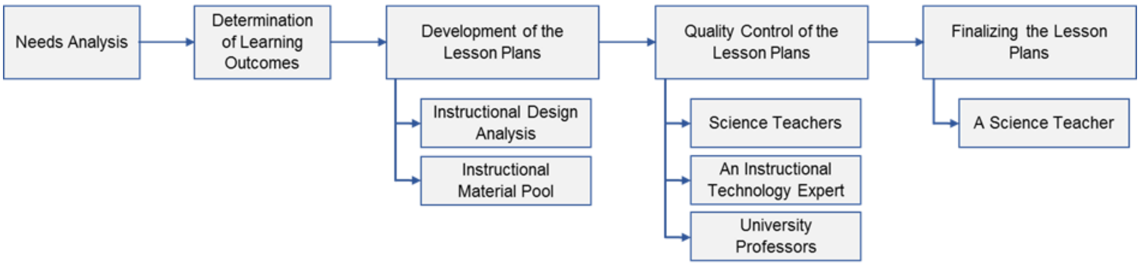

Figure 3. Design and Development of Technology-rich Lesson Plans

Findings

Views on Appropriateness of the Lesson Plans in terms of Instructional Processes

According to the findings in Table 2, science teachers evaluated the lesson plans across various dimensions related to their appropriateness for instructional processes. The results revealed predominantly positive feedback (over 90.0% agreement) from the participants regarding the appropriateness of teaching methods and techniques for the targeted learning outcomes across all three lesson plans. A significant majority of teachers affirmed the effective recall of necessary preliminary information relevant to the learning outcomes (all above 90.0%). Likewise, consensus was observed among most teachers regarding the presence of activities designed to assess students' comprehension of the subject matter (all above 90.0% agreement).

The participants showed a positive stance regarding the content presentation. There was unanimous agreement that the activities within the lesson plans were organized from simple to complex (100%). The majority of teachers acknowledged the suitability of in-class activities for both the specified learning outcomes and the students (over 90.0% agreement, except for LP2). Teachers found the summary sections within the lesson plans adequate (over 90.0% agreement, except for LP2)."

Qualitative findings revealed that neutral opinions for LP2 can be eliminated by including real life examples in summary sections. Participant-3 stated that “More real-life examples could be given for the acquisition of -explains that the work done physically is related to the force applied and the distance taken-”. Another teacher suggested that

> “The summary sections of the LP-2 were mainly in the form of brief explanations of theoretical knowledge. On the other hand, it would be more useful to increase the diversity with different real-life examples in the summary sections”. (Participant-2)

Ultimately, the teachers were asked if the lesson plans were designed in such a way that any science teacher can easily carry out the entire teaching process. Nearly all participants affirmed the ease with which any science teacher could conduct a lesson in its entirety using these plans.

Table 2. Appropriateness of the Lessons Plans in Terms of Instructional Processes

	Disagree			Neutral			Agree		
	LP1	LP2	LP3	LP1	LP2	LP3	LP1	LP2	LP3
Appropriate teaching methods and techniques were used for the corresponding learning gains.	4.8%	0.0%	0.0%	0.0%	4.8%	0.0%	95.2%	95.2%	100%
The necessary preliminary information for the relevant learning gains were recalled.	0.0%	0.0%	0.0%	4.8%	0.0%	0.0%	95.2%	100%	100%
There are in-class activities (question and answer etc.) aiming to evaluate whether students understand the subject or not.	0.0%	0.0%	0.0%	4.8%	4.8%	4.8%	95.2%	95.2%	95.2%
The activities in the lesson plan are presented from simple to complex.	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100%	100%	100%
The lesson plan includes teaching-learning activities appropriate for the corresponding learning gains.	4.8%	0.0%	4.8%	0.0%	4.8%	4.8%	95.2%	95.2%	90.5%
The lesson plan includes teaching-learning activities appropriate for students.	4.8%	4.8%	4.8%	0.0%	9.6%	0.0%	95.2%	85.7%	95.2%
Summary sections (during and at the end of the instruction) of the lesson plans were sufficient.	0.0%	0.0%	0.0%	4.8%	19.0%	0.0%	95.2%	81.0%	100%
The lesson plans have been prepared in such a way that any science teacher can easily carry out a teaching process from start to finish	0.0%	0.0%	0.0%	0.0%	0.0%	4.8%	100%	100%	95.2%

Views on the Technology-Enrichment Dimension of the Lesson Plans

The participating teachers responded to various statements addressing the technology-enrichment dimension of the lesson plans, detailed in Table 3. The first statement focused on whether the integration of technology into teaching would impact teaching time. Teachers agreed that, given the integration of technology-rich learning materials into the teaching process, the relevant learning outcomes could be achieved within the time frame recommended by MoNE. In other words, integrating technology-rich learning materials would not negatively impact the duration of instruction. It is worth noting that three teachers disagreed, and five remained neutral on this matter. In the interview, Participant 1 mentioned that.

> "When technology is involved, some teachers may see activities such as turning on the computer, checking cables and speakers, opening the presentation, or watching a video as time-consuming. This might be the reason that teachers may have considered the use of technology in teaching processes as something that wastes time." (Participant 1)

The teachers highlighted that technologically enriched teaching tends to engage students more. They expressed a collective belief that such an environment has the potential to strengthen students' motivation to learn. Almost identical responses were given for these closely related statements. Beyond indirectly delineating the learning process, teachers also conveyed their perspectives on students' learning. They affirmed that technology-enriched teaching could significantly contribute to the acquisition of targeted learning outcomes. Similarly, they reiterated the consensus on how technology-rich teaching contributes to students' academic success.

Table 3. Technology-Enrichment Dimension of the Lesson Plans

	Disagree			Neutral			Agree		
	LP1	LP2	LP3	LP1	LP2	LP3	LP1	LP2	LP3
Considering the technology-enriched learning processes included in the lesson plans, the relevant learning gains can be achieved in accordance with the time recommended by MoNe.	9.6%	4.8%	0.0%	4.8%	14.3%	4.8%	85.7%	81.0%	95.2%
The technology-rich learning environment would help engage students more	9.6%	0.0%	0.0%	4.8%	0.0%	4.8%	85.7%	100%	95.2%
The teaching environment enriched with technology would increase students' motivation to learn	9.6%	0.0%	0.0%	4.8%	0.0%	0.0%	85.7%	100%	100%
Technology-rich teaching processes will contribute to better learning of the relevant learning gains.	9.6%	0.0%	4.8%	4.8%	4.8%	4.8%	85.7%	95.2%	90.5%
Teaching processes enriched with technology will contribute to the academic success of students.	9.6%	0.0%	0.0%	4.8%	4.8%	4.8%	85.7%	100%	90.5%
I believe I will experience more professional satisfaction when I carry out teaching processes similar to the technology-enriched lesson plans I reviewed.	14.3%	4.8%	4.8%	4.8%	9.6%	4.8%	81.0%	85.7%	90.5%

Such pre-designed lesson plans and materials will reduce the preparation time for the instructional processes.	4.8%	0.0%	0.0%	9.6%	0.0%	14.3%	85.7%	100%	85.7%
For all learning gains, I think that pre-designed lesson plans enriched with technology with materials should be provided to teachers.	9.6%	4.8%	0.0%	0.0%	9.6%	4.8%	90.5%	85.7%	95.2%
With such pre-designed lesson plans, I think that science teachers will prefer technology-enriched teaching processes by changing their traditional teaching.	9.6%	0.0%	0.0%	9.6%	4.8%	0.0%	81.0%	95.2%	100%

Teachers assessed the potential impacts of technology-rich lesson plans on both themselves and their students. As indicated in the preceding Table 3, 85.7% of the participants stated that conducting similar technology-rich teaching processes, based on the technology-rich lesson plans they reviewed, would enhance their professional satisfaction. The percentage of teachers expressing disagreement or neutrality toward this statement was 14.3%. Due to the relatively high percentage of negative views, the qualitative interviews included a question aimed at further elaboration on this aspect. Participant-2 responded to this query as follows:

> “It is necessary to consider that there is more than one factor affecting teachers' professional satisfaction. Although a high-quality teaching process has the potential to contribute to teachers’ professional satisfaction, some teachers may have different priorities. Therefore, technology-integration may not have been prioritized by these teachers regarding this statement. In addition, since we could not directly observe the contribution of technology-rich lessons to test achievement, teachers may have been undecided in this respect.” (Participant 2)

Among the teachers, 90.5% noted that offering pre-designed lesson plans would reduce their preparation time for teaching, whereas 9.5% either disagreed or remained neutral. Similarly, 90.5% of the teachers advocated the provision of pre-designed lesson plans and materials covering all learning outcomes. Finally, 85.7% of teachers agreed that science teachers would prefer technology-rich instructional processes over traditional teaching methods. In contrast, 14.3% stated that science teachers would have no intention of changing their traditional teaching processes even with pre-made technology-rich lesson plans.

Demographic Characteristics of Teachers and their Views

Teachers’ perspectives on technology integration were examined in relation to gender, work experience, and self-reported computer proficiency. They were prompted to provide feedback on various aspects, including professional satisfaction, reducing the preparation time for the instructional processes, providing pre-designed lesson plans for all learning outcomes, and their intention toward adopting technology-rich teaching methods over traditional approaches, based on the lesson plans they reviewed.

Is There a Significant Difference between the Demographic Characteristics of Teachers and their Views on Professional Satisfaction?

Chi-square analysis revealed no statistically significant difference between expected and observed outcomes regarding professional satisfaction across teachers' gender, work experience, and self-reported computer competence (see Table 4). In essence, no substantial association was found between professional satisfaction and any of the demographic variables.

Table 4. Chi-Square Analysis Concerning Professional Satisfaction and Demographic Variables

Expression	Variable	Variable	n	Agree	Disagree	X^2	p
I believe I will experience more professional satisfaction when I carry out teaching processes similar to the technology-rich lesson plans I examined.	Gender	Male	15	11	4	2.465	1.198
		Female	48	43	5		
	Work experience	Inexperienced	27	23	4	.011	.597
		Experienced	36	31	5		
	Computer competence	Advanced	53	44	9	1.981	.332
		Intermediate	10	10	0		

Is There a Significant Difference between the Demographic Characteristics of Teachers and their Views on Preparation Time for the Instructional Processes?

Chi-square analysis findings indicate no statistically significant difference between expected and observed outcomes regarding the reduction of preparation time across teachers' gender, work experience, and self-reported computer competence (see Table 5).

Table 5. Chi-Square Analysis Concerning Preparation Time and Demographic Variables

Expression	Variable	Variable	n	Agree	Disagree	X^2	p
Such pre-designed lesson plans and materials will reduce the preparation time for the instructional processes.	Gender	Male	15	14	1	.187	.559
		Female	48	43	5		
	Work experience	Inexperienced	27	23	4	1.535	.210
		Experienced	36	34	2		
	Computer competence	Advanced	53	47	6	1.251	.338
		Intermediate	10	9	1		

Is There a Significant Difference between the Demographic Characteristics of Teachers and their Views on Providing Pre-designed Lesson Plans and Materials?

The outcomes derived from the chi-square analysis revealed that in terms of providing pre-designed lesson plans for all learning outcomes, no statistically significant difference existed between the expected and observed results based on teachers' gender, work experience, and self-reported computer competence (see Table 6). This suggests the absence of a significant correlation between the provision of pre-designed lesson plans and each demographic variable.

Table 6. Chi-Square Analysis Concerning Providing Pre-designed Lesson Plans and Demographic Variables

Expression	Variable	Variable	n	Agree	Disagree	X^2	p
For all learning outcomes, I think that pre-designed lesson plans enriched with technology with materials should be provided to teachers.	Gender	Male	15	15	0	2.072	.181
		Female	48	42	6		
	Work experience	Inexperienced	27	26	1	1.857	.178
		Experienced	36	31	5		
	Computer competence	Advanced	53	48	5	.003	.662
		Intermediate	10	9	1		

Is There a Significant Difference between the Demographic Characteristics of Teachers and their Views on Preferring Technology-rich Teaching Processes?

Chi-square analysis results indicate that, in terms of the preference for technology-rich teaching approaches, no significant difference exists between the expected and observed results concerning teachers' gender, work experience, and self-reported computer competence (see Table 7). This implies the absence of a significant association between the preference for technology-rich teaching processes and each demographic variable.

Table 7 Chi-Square Analysis Concerning Preferring Technology-Enriched Teaching Processes and Demographic Variables

Expression	Variable	Variable	n	Agree	Disagree	X^2	p
With such pre-designed lesson plans, I think that science teachers will prefer technology-rich instructional processes by changing their traditional teaching.	Gender	Male	15	14	1	.933	.310
		Female	48	40	8		
	Work experience	Inexperienced	36	34	3	.389	.403
		Experienced	27	30	6		
	Computer competence	Advanced	53	44	9	1.981	.187
		Intermediate	15	10	0		

Discussion and Conclusion

Instructional Dimension of the Lesson Plans

The results revealed that teachers acknowledged the adaptation of the lesson plans with teaching methodologies, techniques, and their relevance to the learning objectives. Likewise, the teachers noted that the lesson plans encompassed instructional activities suitable for both the students and the targeted learning objectives. Furthermore, recalling preliminary information, in-class assessment activities with feedback, presenting information from simple to complex, and the summary sections within the lesson plans received positive evaluations. Salam et al. (2019) highlighted the criticality of planning and preparation as the primary phase in the technology integration process. In our research, an instructional technologist and three science teachers meticulously analyzed the learning outcomes to devise optimal methods for their enhancement through technological integration. The positive responses of the teachers might be attributed to the systematic design of the lesson plans, which encompassed each stage from initial analysis to finalization. Typically, studies on technology integration involve the external addition of technology into the instructional process rather than adopting a holistic approach (Gülbahar, 2007). Conversely, a comprehensive strategy is advocated for the seamless integration of technology throughout the teaching process (Wang & Woo, 2007).

This study highlights the substantial impact of technology integration on the instructional process, as perceived by the teachers. The positive opinions expressed by the teachers regarding the appropriateness of the lesson plans in instructional contexts might stem from the comprehensive design and development process considering various factors.

The lesson plans were primarily designed and developed adhering to Gagne's nine events of instruction (Gagné, 1985), signifying a theoretical underpinning for the instructional processes. Recalling the necessary preliminary information, conducting in-class activities, presenting information from simple to complex, and integrating summary sections within the lesson plans received positive evaluations. Despite the overall positive outcomes, teachers recommended incorporating additional real-life examples specifically within the summary sections, as revealed in the qualitative interviews. The qualitative phase of the study indicates that addressing this concern could be achieved through an increased inclusion of real-life examples.

Teachers perceived the pedagogical value of the lesson plans, partly because of the collaborative effort involving science teachers in their development. This collaborative team deliberated on the integration of specific technologies and materials at various stages of the lesson, identifying their optimal utilization within different activities. Consequently, the materials adhered to a holistic structure, directly enriching the relevant sections of the lesson. These outcomes align with earlier studies (Syh-Jong, 2008), indicating that team-teaching practices not only facilitate the integration of effective teaching strategies but also encourage the use of technology.

Technology-Enrichment Dimension of the Lesson Plans

Incorporating teachers into the instructional design process is recommended, given their unique and valuable insights into leveraging technology within the classroom (Cober et al., 2015). On the other hand, teachers commonly find it difficult to change the teaching culture that they are comfortable implementing. (Salinas, 2008). Even if some barriers, such as technical support or technology accessibility, have been removed, pedagogical attitudes and additional concerns can remain significant barriers to integrating technology in the classroom (Taimalu & Luik, 2019). These concerns include the perceived increase in workload (Jääskelä et al., 2017) and the limited time available for designing technology-rich activities (Gerard et al., 2010; Voogt & McKenney, 2017). Wozney et al. (2006) found that teachers' concerns about the time and effort required for technology integration had a negative impact on their tendency to use technology for instruction. Therefore, due to these concerns (time, workload, resistance to change, etc.), teachers often prefer the traditional teaching methods they are accustomed to (Ardıç, 2021).

Conversely, our research indicates that when teachers are provided with pre-designed technology-rich lesson plans, they exhibit a willingness to transition from traditional teaching methods to technology-rich approaches. These findings align with prior studies (Crompton & Sykora, 2021), emphasizing that providing educators with tangible, practical examples can significantly enhance their adoption of digital technologies. Technology-rich lesson plans, serving as guidelines for the teaching process, can help teachers to initiate technology integration.

A change in the teaching process often raises concerns among teachers about keeping up with the topics scheduled in the curriculum timetable. Previous studies have noted that teachers' concerns regarding time management increase with changes in examination systems (Şad & Şahiner, 2016), alterations in methodologies (Pons Lelardeux et al., 2020), and the integration of technology into instructional practices (Boadu et al., 2014).

Although teachers acknowledge the educational benefits of technology-rich learning environments, they often ignore these advantages to adhere to their curriculum's timetable (Kirkscey, 2012; Valiande & Tarman, 2011). A noteworthy finding of our study is the positive response of teachers toward technology-rich lesson plans concerning the allocated time for specific learning outcomes. The key factor contributing to this positive outcome might be the meticulous design of technology integration concerning lesson durations. In other words, the team devised lesson plans by calculating the duration required for each lesson stage, including the additional time for technology integration, thereby reducing pressure to adhere to the curriculum, aligning with Eteokleous's suggestions (2008). Pre-designed lesson plans contribute positively not only to teachers' instruction time but also to their preparation time before the lesson. Teachers mentioned that the availability of pre-designed lesson plans would additionally reduce the time they spend preparing for lessons. This corresponds with prior research (Weisberger et al., 2021), indicating that shortening work hours or creating a pre-prepared technology-enhanced curriculum can reduce teachers' workload and stress, potentially leading to greater satisfaction and enhanced integration into their lessons.

The TAM emphasizes that perceived usefulness significantly impacts the adoption of technology (Davis, 1989). Various studies have confirmed Davis' principle, highlighting the important role of perceived usefulness in teachers' intention to use technology within the classroom (Granić & Marangunić, 2019; Teo, 2009). To foster this perceived usefulness, offering concrete examples is crucial. These instances may include technology-rich field experiences (Meagher, Ozgun-Koca, & Edwards, 2011) or, as demonstrated in this research, technology-rich lesson plans. Our study highlights that teachers perceive technology-rich lessons as contributing to fostering student engagement, motivation, and enhanced learning, consequently augmenting their academic performance. This aligns with existing literature underlining technology integration's positive impact on student engagement and motivation (Akram et al., 2022; Ottenbreit-Leftwich et al., 2010) as well as academic achievement (Muhammad et al., 2020; Carle et al., 2009). For successful technology integration, it's crucial for teachers to believe in the advantages of technology (Tondeur et al., 2008). These advantages can enhance student engagement and motivation, leading to improved learning and academic achievement.

While numerous studies have investigated teachers' professional satisfaction regarding diverse factors (Li & Yu, 2022), recent research specifically addressing professional satisfaction linked to technology integration is scarce. Wahyudi et al. (2018) noted that while technology may not directly impact teachers' performance, professional satisfaction affects their performance. Teachers, upon reviewing our technology-rich lesson plans, expressed a greater feeling towards professional satisfaction if they were to implement similar teaching methodologies reflected in the plans. While existing research primarily examines the impact of teachers' professional satisfaction on student achievement (e.g., Banerjee et al., 2017), it is noteworthy that an increase in students' academic performance also influences teachers' professional satisfaction. Anticipating a positive impact on students' academic success, teachers likely link technology-rich lesson plans with their professional satisfaction.

Teachers' perspectives on technology-rich teaching were assessed based on their demographic profiles. The results indicated an overall positive perception of the technology-rich lesson plans. Notably, there were no significant differences in teachers' opinions across gender, work experience, and computer competency.

Contrary to prior studies highlighting either positive or negative differences about technology integration on teacher experience (Inan & Lowther, 2010; Hernandez-Ramos, 2005; Russell et al., 2003; Holmes et al., 2013), this study found that work experience did not notably influence teachers' perceptions regarding professional satisfaction, lesson preparation time, demanding pre-designed lesson plans, and preferring technology-rich teaching processes. This aligns with Perrotta's (2013) claim that work experience may not be a predictor of technology integration.

Prior literature presents conflicting findings on gender effects in technology integration among teachers (Tondeur et al., 2008; Wozney et al., 2006; Perrotta, 2013; Tweed, 2013; Teo et al., 2015). However, the outcomes of this study indicate that gender did not significantly influence teachers' perspectives on professional satisfaction, lesson preparation time, demanding pre-designed lesson plans, and preferring technology-rich teaching processes.

Some studies suggest a positive impact of computer competency on several factors, such as attitude and intention toward technology adoption (Baturay et al., 2017). However, despite findings in the literature (Antonietti et al., 2022; Backfisch et al., 2021) indicating a direct or indirect correlation between teachers' computer proficiency and their attitudes toward technology integration, this study did not find such a relationship.

The synthesis of these positive findings highlights a clear preference among teachers to adopt technology-rich teaching over traditional approaches. As an indicator of this adoption, teachers express a need for pre-designed technology-rich lesson plans covering all learning objectives. Facilitating conditions significantly impact teachers' technology integration intentions (Atsoglou & Jimoyiannis, 2011). Thus, a necessity arises for well-designed, technology-rich lessons for a more positive teaching experience. Effective technology integration examples promote teachers' adoption of technology-rich learning processes. In conclusion, teachers are ready for technology integration but require a catalyst and support. Thus, providing pre-designed technology-rich lesson plans can stimulate teachers' intentions to integrate technology into their teaching practices.

Limitations and Suggestions for Further Research

An important limitation of this study is the examination of teachers' perspectives on technology-rich teaching processes solely through theoretical assessment rather than practical implementation. Inferences drawn from reviewing lesson plans may differ from those based on actual teaching experiences. Therefore, future research should focus on assessing the opinions of teachers who actively implement technology-rich lesson plans in real classroom settings.

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According to the decision dated 04.03.2021 with reference number E.29623 from the Kocaeli University Social and Human Sciences Ethics Committee in Türkiye, a unanimous decision was made that there are no ethical concerns regarding the implementation of this study from the perspective of scientific research and publication ethics.

Conflict of Interest:

On behalf of all authors, the corresponding author states that there is no conflict of interest.

Informed Consent:

The participants were informed about the research and data collection procedure and signed a written informed consent, indicating their willingness.

Data availability:

Raw data will be shared with researchers upon request from the corresponding author.

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