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A PROPOSED FRAMEWORK FOR TECHNOLOGY INTEGRATION IN PUBLIC EDUCATION: AN EMPIRICAL STUDY OF TEACHERS' CHALLENGES AND SOLUTIONS

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ABSTRACT

Integrating technology into the educational process has become essential for improving teaching and learning practices. However, its effectiveness depends to a large extent on the ability of teachers to utilize digital tools within classrooms. Despite the efforts made, many educational institutions still face difficulties that limit the optimal use of technology. This study examined the most significant challenges associated with integrating technology into public schools in Benghazi and explored whether these challenges varied according to gender, specialization, academic qualification, and years of teaching experience. A descriptive-analytical approach was employed. Data were collected through a questionnaire distributed to 171 teachers in preparatory schools during the 2023-2024 academic year. The results showed that the challenges related to technology integration were widespread (M = 3.90), with challenges identified at both the teacher and school level. No statistically significant differences were found according to gender, specialization, educational qualification or years of teaching experience. This suggests that these obstacles are structural rather than individual in nature. Based on these results, a data-driven framework was proposed, drawing on the Educational Technology Content Knowledge Model (TPACK) and systems theory. This framework provides a structured and sustainable approach for improving the integration of technology in education, through practical guidelines relating to professional development, infrastructure development, curriculum adaptation, and continuous assessment. Its role is not limited to improving the efficiency of technology use within classrooms, but also provide a basis for further testing in other educational contexts facing similar systemic challenges.

Keywords: *Technology Integration, TPACK Model, Systems Theory, Educational Challenges, Benghazi Schools.*

1. INTRODUCTION

Contemporary education is witnessing a radical transformation due to cognitive progress and scientific development, as educational technologies have contributed to improving the quality of the educational process and reconsidering curricula and teaching methods. Educational technology is no longer merely an optional supplementary tool; it has become an essential part of the educational system, encompassing planning, implementation, and evaluation, provided that it is employed according to clear educational objectives and that the necessary requirements for its successful use are met [26].

These technologies contribute to teaching large numbers of students without the constraints of time and place, enabling dialogue and discussion, and providing access to multiple sources of knowledge, in addition to taking into account individual differences and encouraging both self-

learning and group learning. Despite this, obstacles still exist that limit their effective use, most notably the high cost and the lack of teacher training in their use. Therefore, this study aims to identify the most prominent problems associated with the use of technology from the perspective of public-school teachers in Benghazi.

The significance of this study lies in highlighting the problems of using technology in education from the point of view of teachers in the city of Benghazi. It also seeks to propose possible solutions to these problems related to the use of technology, in addition to highlighting the most prominent challenges facing decision-makers.

This study may open new horizons for researchers to study other issues related to the challenges of employing technology in education. It is also hoped that this study will offer practical suggestions that contribute to developing realistic solutions to the problems that teachers face when using technology.

2. THE PROBLEM OF THE STUDY

Technology plays an important role in education by supporting its integration into classrooms and enhancing the educational process. it can help teachers save time during lessons, replace traditional methods with modern approaches, and make learning more engaging.

However, it can be said that the problems associated with the use of technology in our society can be summarized as follows: some teachers do not realize the importance of employing it in education, and there is a scarcity of teachers with the experience and required skills to use modern devices. This also manifests itself in some students' lack of experience in using technology, whether at home or at school, or in its misuse in ways unrelated to the educational context.

In addition to that, schools have limited material resources and lack of contemporary computer technology in their laboratories that is capable of running educational programs that support teachers, which negatively affects the educational process. A study by [27] indicated that one of the most prominent factors contributing to the decline in student achievement is the limited use of technology by teachers and their reliance on traditional teaching methods.

In addition to the above, the researchers also identify the lack of prior preparation and planning for adopting the use of technology in education more widely in our society, including the weak focus on clarifying its role in improving students' academic achievement and helping teachers deliver lessons in easier ways, and more appealing.

Given the aforementioned negative impacts on the educational process and its various components, including teachers and students, this study aims to identify the most prominent "problems with technology use from the perspective of teachers in public schools in Benghazi".

The research problem can be summarized in the following questions:

The first question
What are the problems associated with the use of technology in teaching from the perspective of teachers in public schools in Benghazi?

The second question
Are there statistically significant differences in the respondents' answers regarding problems associated with the technology use that can be attributed to the variables (gender, specialization, type of qualification, years of experience)?

3. STUDY OBJECTIVES

This study aims to identify the problems of using technology in teaching from the perspective of teachers in public schools in the city of Benghazi, and to investigate whether there are statistically significant differences between the responses of the respondents regarding these problems that can be attributed to the variables (gender, Specialization, type of qualification, years of experience.

4. STUDY LIMITATIONS

Subject: The findings of this study are limited to highlighting the most significant challenges in using technology in education from the perspective of teachers in public schools in Benghazi**.**
Time limit: During the academic year(2024–2023)
location: Public schools in Benghazi, Libya.
Specific Target: Middle school teachers were targeted.

5. STUDY TERMINOLOGY

The following are definitions of the most important terms used in this study:

- **Technology:** "Technology encompasses human knowledge, methods of work, equipment, materials, communications, electronics, and various work and processing systems used in carrying out the organization's business activities" (Fahmi, 2009, p.40).
- **Educational technology:** "It is the scientific theoretical foundations translated practically into modern educational tools and electronic technologies, and diverse systems used by teachers to facilitate the teaching and learning process" [5].
- **Technology use challenges**: these are operationally defined as the obstacles that hinder teachers from using technology effectively and optimally, as measured by the instrument used in this study and designed for this purpose.
- **Teachers**: operationally defined as the individuals tasked with teaching educational materials, who convey information to students and fulfill their educational mission to the fullest extent.
- **Public schools**: these are operationally defined as educational institutions (public schools) that provide teachers with the opportunity to teach students educational subjects free of charge.
- **The preparatory stage**: is operationally defined as an intermediate stage between the primary and secondary stages, and it is an extension of the primary stage.
- **Preparatory stage teachers:** these are the people assigned to teach preparatory stage students from the first preparatory grade to the third preparatory grade, and who teach educational materials and providing students with the required information.

6. THEORETICAL FRAMEWORK AND PREVIOUS STUDIES

6.1 Theoretical Framework

- **The Concept of Technology in Education**

The term "educational technology" is originally an Arabicized term, introduced into the Arabic language as a synonym for the term "educational techniques." The word technology is derived from the Latin language, where it is composed of two parts: (Techno), which means art or craft, and (Logic), which means study or science. Hence, the term technology refers to the scientific applications of knowledge in various fields. The term "technology" refers to all the methods humans develop or use in their inventions and discoveries to meet their needs and fulfill their desires.

According to [1], it is "that science which aims to integrate educational materials and tools and present them for the purpose of implementing and enhancing teaching, and it is divided into two systems: educational tools (hardware), and educational materials (software) which include printed and photographed materials." Similarly, as defined by [18], it is "the study and practice of ethics that aims to facilitate learning and improve performance through the design, use, and management of appropriate technological resources and processes".

- **The Importance of Technology in Education**

Technology plays the role of a guide that helps the teacher in presenting the scientific material to students, as it contributes to changing the way lessons are presented, thus providing greater and easier opportunities for understanding and learning. It also provides a rich source of information needed by both teachers and students, and has become an effective means of communication, as the internet has created valuable opportunities for continuous interaction between teachers and students.

- **Using Technology in Education**

The use of technology in education contributes to achieving numerous goals, including providing diverse learning environments, giving learners greater opportunities for self-directed learning, developing their skills and experiences, helping teachers enhance their capabilities, and improving methods of presenting lessons in an engaging manner. It also contributes to addressing individual differences among learners by providing diverse sources of knowledge and preparing them to face scientific challenges, as indicated in the study by [6].

Technology in education is no longer merely a set of tools that can be used or dispensed with; rather, it has become an essential part of the integrated educational system, which relies on a systems approach based on inputs, processes, outputs, and feedback [27].

The use of technology also helps to make the educational environment more conducive to active and collaborative learning, and contributes to the development of research, inquiry, and evidence proof skills, according to a study by [23].

The researchers believe that the use of technology provides several advantages, including: the ability for students to share their study files, record notes, allowing teachers to communicate with students, conducting electronic tests, and setting appropriate times for answering and submitting assessments. It also contributes to motivating learners to think and activate their senses, and making them more interactive and active in the educational process, which enhances scientific thinking and contributes to achieving educational goals effectively.

- **Problems of Using Technology in Education**

There are many problems associated with using technology in education, including the lack of modern tools and equipment in classrooms, as most school buildings are old and not equipped for the use of educational technology.

This is also evident in the neglect by some teachers of all that is new in this field, and their reliance on traditional methods in explaining lessons, in addition to the weak financial support for schools, and the lack of specialized technical staff in maintaining equipment and updating its systems, as most computer labs contain Outdated equipment requires constant maintenance, as indicated in the study by [4].

Furthermore, there is a lack of training courses that qualify and encourage teachers to use educational technology, and some curricula are not suitable for employing these technologies. Several teachers also feel that using technology is a burden and may diminish their role in the educational process.

Another challenge is the lack of personal computers at home for some teachers and students, which hinders communication between them, in addition to the lack of activities that support the use of technology, especially during summer vacations. This may be due to some teachers' fear of chaos or student distraction. In locations unrelated to education, as indicated by the study by [5].

Furthermore, most teachers rely on traditional methods for assessing and evaluating educational material, neglecting the use of modern teaching technologies, which contributes to weakening the effectiveness of the educational process.

It is clear from the previous presentation that the studies addressed the obstacles to using technology from multiple angles, including the related aspects of the teacher, such as lack of training and continued use of traditional methods, and aspects associated with the school environment, such as poor Equipment, technical and financial support, and the inadequacy of some curricula for using technology.

Despite the multiplicity of these aspects, most of them are presented as a group of obstacles that affect the use of technology, while there remains a need to look at it as interconnected factors that collectively affect the process of integrating technology into education. From this standpoint, studying this problem requires combining the factors related to the teacher and the factors related to the school. Within a more integrated vision.

6.2 Critical Analysis of Previous Studies and the Research Gap

Previous studies have consistently highlighted a number of challenges hindering the integration of technology into education. Key among these is inadequate teacher training, a lack of technical resources and equipment, insufficient technical and institutional support, and a continued reliance on traditional teaching methods. While these studies have been valuable in identifying obstacles to the use of technology in education, most have focused primarily on descriptively identifying the problems, without examining teacher-related and school-related obstacles together within a unified educational context.

A review of the literature also reveals a scarcity of studies dedicated to examining the reality of Libyan schools—particularly at the preparatory education level in the city of Benghazi. This represents a significant contextual gap, given that the potential for technology integration varies depending on the available environment, the extent of institutional support, and teacher preparation. Consequently, findings derived from other educational settings may not fully explain the

challenges associated with integrating technology into the educational process.

Furthermore, the diagnosis of technology integration challenges in several previous studies has not always been coupled with an integrated framework that translates field findings into interconnected areas for intervention and improvement—one that simultaneously addresses teacher- and school-related factors and utilizes these findings to construct a structured framework for integrating technology into education. Thus, this study seeks to help bridge the gap between diagnosing existing challenges and providing a structured approach to addressing them within the context of public education in Benghazi.

7.STUDY METHODOLOGY

The researchers used the descriptive method as it was best suited to the study's objectives and nature.

7.1 Study Population

The study population consists of all male and female teachers of the preparatory stage in public schools in Benghazi – Al-Salawi branch, totaling (235) teachers during the second semester of the 2023/2024 academic year.
In another method, it was mentioned that the number of teachers in public schools in the city of Benghazi - Al-Salawi branch reached (31886), and by using the statistical equation it was concluded that the study population is estimated at (370), and with a sample of (147). However, this method was not accurate due to the lack of up-to-date statistics on the number of teachers. Therefore, the first method, which relies on counting the number of teachers in each targeted school, was used.

7.2 Study Sample

A random sample of (200) male and female teachers was selected, distributed across (5) schools affiliated with the Educational Services Office - Al-Salawi Branch. (179) questionnaires were retrieved, and (8) questionnaires were excluded as unsuitable for data entry, leaving a final number of (171) questionnaires suitable for analysis. Table (1) below illustrates this.

Table 1: Distribution of the Study Sample by School

Schools	Number
Al-Shayma	25
Al-Ula	42
The Foundations of Knowledge	47
Al-Yarmouk	40
Musa ibn Nusayr	17
Total	**171**

7.3 Sample Characteristics

7.3.1 Demographic Characteristics of the Teacher Research Sample by Gender

The following table shows the demographic characteristics of the study sample of teachers.

Table 2: Demographic Characteristics of the Study Sample of Teachers by Gender

Gender	Number	Percentage
Female	165	96.5%
Male	6	%3.5
Total	**171**	**100%**

As shown in Table 2, the analysis of the study sample indicates that the percentage of female teachers is considerably higher than that of male teachers, which may be attributed to the greater tendency of females to work in the education sector. Figure 1 shows the distribution of the study participants by gender.

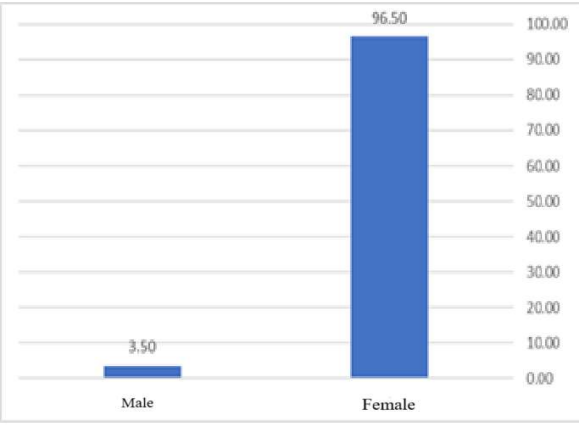

Figure 1: The Distribution of Study Participants by Gender

7.3.2 Demographic Characteristics of the Teacher Research Sample by Specialization

The demographic characteristics of the study sample of teachers according to the specialization variable are presented in Table 3.

Table 3: Demographic Characteristics of the Study Sample of Teachers by Specialization

Specialization	Number	Percentage
Scientific	94	%55.0
Literary	77	%45.0
Total	**171**	**100%**

Table (3) shows that the number of teachers with scientific specializations is higher, as their number reached (94) male and female teachers, with a percentage of (55.0%), and the number of teachers with literary specializations is lower, as their number reached (77) male and female teachers, with a percentage of (45.0%). The reason for this may be due to the large number of scientific subjects in the preparatory stage, and this explains the need for a larger number of teachers with scientific specializations. See Figure (2).

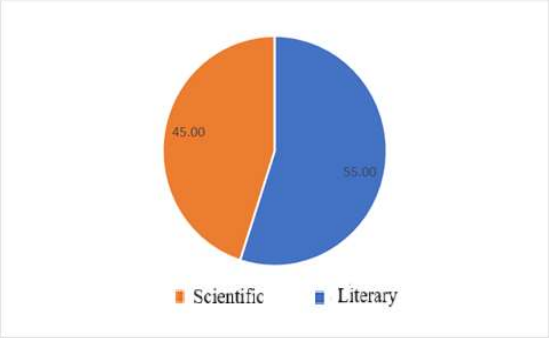

Figure 2: Distribution of Study Participants by Specialization

7.3.3 Demographic Characteristics of the Teacher Research Sample by Educational Qualification

The demographic characteristics of the study sample of teachers according to their educational qualification are presented in Table 4.

Table 4: Demographic Characteristics of Teachers by Educational Qualification

Qualification Type	Number	Percentage
Educational	137	%80.1
Non-educational	34	%19.9
Total	**171**	**%100**

Table (4) also shows that the number of teachers with a higher educational qualification was (137), representing (80.1%), while the number of teachers with a non-educational qualification was (34), representing (19.9%). This may be explained by the fact that most graduates of faculties of education are employed in the education sector, which is undoubtedly a positive outcome. This suggests that focusing more on training these graduates to use technology effectively may contribute significantly to reducing the challenges associated with technology use among teachers. Figure (3) shows the distribution of study participants according to educational qualifications.

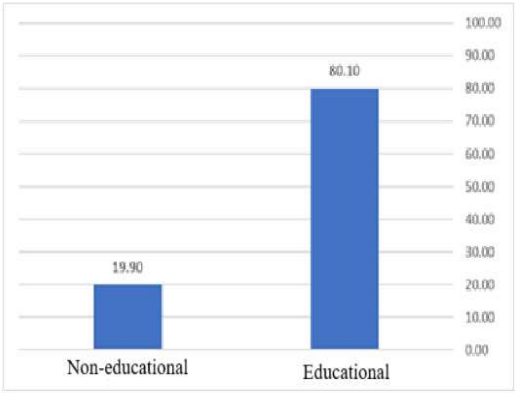

Figure 3: Distribution of study participants by educational qualification

7.3.4 Demographic Characteristics of the Teacher Research Sample by Years of Experience

The demographic characteristics of the study sample of teachers according to their years of experience are presented in Table 5.

Table 5: Demographic Characteristics of the Study Sample of Teachers by Years of Experience

Years of Experience	Number	Percentage
Less than 5 years	12	%7.0
5 to 10 years	24	%14.0
More than 10 years	135	%78.9
Total	**171**	**100%**

Table (5) shows that teachers with more than ten years of experience were the most numerous, totaling (135) teachers, representing (%78.9)of the sample. Teachers with 5 to 10 years of experience numbered 24, representing 14.0% of the total, while those with less than 5 years of experience were the smallest group, numbering 12, or 7.0%.

This may be attributed to the fact that the majority of the study samples consisted of highly experienced teachers who had not received sufficient training in modern technology. Figure (4) illustrates the distribution of the study participants according to their years of experience.

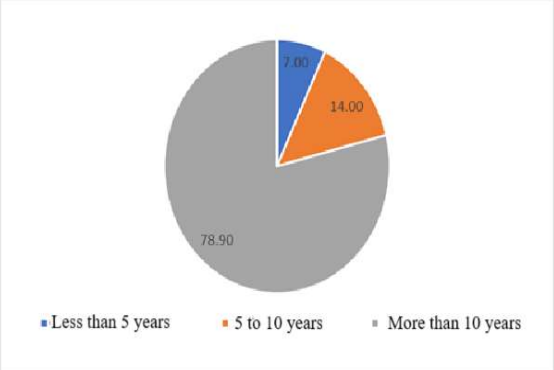

Figure 4: Distribution of Research Participants by Years of Experience

7.4 Research Instrument

This is the instrument used to collect primary data to answer the research questions. A paper questionnaire consisting of two parts was used .The first part was used to collect primary data related to the characteristics of the study sample in terms of: (gender, specialization, educational qualification, years of experience).
The second part was dedicated to measuring the level of problems related to the use of technology in education from the teachers' perspective. It was divided into two sections: problems specific to the teacher and problems specific to the school. The questionnaire consisted of 20 statements that were reviewed and validated.
The five-point Likert scale was used to measure participants' responses based on scores and weighted averages. The scale was divided as follows:1-1.79 (Very low), 1.8 - 2.59 (low), 2.6 - 3.39 (moderate), 3.4-4.19 (high),and 4.2- 5: (Very high).

Table 6: Five-Point Likert Scale

Scale	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Quantitative Assessment	1	2	3	4	5

7.5 Validity and Reliability of the Study Instrument

The validity of the study instrument was measured through content validity by presenting the questionnaire to six experienced experts in the field. The researchers made the necessary deletions and modifications to the items based on the suggestions provided by the experts in order to produce the final questionnaire version. To verify the reliability of the scale, the instrument was administered to a pilot sample of 20 teachers, and internal consistency was measured using Cronbach's alpha, which is commonly used as an indicator of a reliable rate of the actual application.

Table 7: Validity and Reliability Coefficient

Scale	Reliability	Validity
Questionnaire	0.704	0.839

7.6 Statistical Methods Used

To achieve the study objectives, the following statistical methods were used:

- Cronbach's Alpha coefficient was used to verify the reliability of the questionnaire.
- Numerical frequencies (N) and percentages (Percent) were used to identify the demographic characteristics of the study participants.
- To address the challenges of using technology in education from the perspective of teachers, the arithmetic mean was used to rank the items, and the standard deviation was used to

illustrate the degree of dispersion in individual responses.

- A t-test was used to detect statistically significant differences at the ($\alpha \leq 0.05$) level between the mean responses of the study participants attributable to the variables of gender, specialization, and type of qualification.
  - One-way ANOVA was also used to detect statistically significant differences ($\alpha \leq 0.05$) between the mean responses of study participants regarding technology use problems, attributable to the variable of years of experience.

8. Results

This section presents the study's findings through the answers to its questions and the analysis the questionnaire items to identify the challenges of using technology in education from the perspective of teachers in public schools in Benghazi.

8.1 Criteria for Evaluating Results

The five-point Likert scale was used to interpret the results according to the arithmetic mean score of the study sample, as presented in Table 8.

Table: Standard for Interpreting Results Based on the Arithmetic Mean

Score	Range of the Arithmetic Mean	Rating
1	1 – 1.8	Very Low
2	1.8 – 2.6	Low
3	2.6 – 3.4	Medium
4	3.4 – 4.2	High
5	4.2 – 5	Very High

8.1.1 The First Study Question

"What are the problems of using technology in teaching from the perspective of teachers in public schools in Benghazi?"

To answer this question, the means and standard deviations for the questionnaire items were calculated, and the score for each item was determined

First Aspect: Challenges Related to the Teacher

The arithmetic means and standard deviations of the teacher-related challenges were calculated as shown in Table 8.

Table 8: Arithmetic Means and Standard Deviations of Teacher-Related Challenges

No	Teacher-related Problems	Arithmetic Mean	Standard Deviation	Rating	Order
1	Teachers lack knowledge of technology use.	3.62	1.19	High	7
2	Some teachers rely on traditional methods for evaluating and assessing the curriculum, neglecting modern technology.	3.51	1.16	High	8
3	Not all teachers have a computer at home to communicate with students and discuss educational matters.	3.95	.960	High	4
4	There are few classroom activities that support the integration of technology in education.	4.12	.940	High	2
5	Teachers tend to prefer traditional teaching methods due to the extensive curriculum.	3.72	1.14	High	5
6	Teachers fear disruption and disorder when using technology during lessons.	3.23	1.22	Medium	9
7	Teachers worry that students will become distracted by websites unrelated to education.	4.02	1.04	High	3
8	Some teachers believe that using technology in education may reduce student interaction in the classroom.	2.75	1.15	Medium	10
9	School administrations lack awareness of the importance of technology use.	3.66	1.14	High	6

No	Teacher-related Problems	Arithmetic Mean	Standard Deviation	Rating	Order
10	There is a shortage of training courses for teachers who are unfamiliar with using technology in education.	4.21	1.01	Very High	1
Total Averages		**3.68**	**0.58**	**High**	

Table (8) shows that teachers' responses regarding teacher-specific problems had a high overall average of (3.68) and a standard deviation of (0.58), indicating that these problems are highly prevalent in the view of the study sample.

The arithmetic means varied between average, high, and very high (2.75 – 4.21), with item (10), which was "the scarcity of training courses for teachers who lack knowledge of using technology," having the highest arithmetic mean (4.21) and a standard deviation of (1.01) a very high rating.

Then came item (4) with an average of (4.12), which relates to the lack of classroom activities that support the use of technology, followed by item (7) with an average of (4.02), which is represented by teachers' fear of students being preoccupied with non-educational sites, and then item (3) with an average of (3.95), which is related to the lack of all teachers possessing Special computer devices, then paragraph (5) with an average of (3.72) and was related to the teacher's inclination towards traditional education, while paragraph (6) came with an average of.(3.23) with a standard deviation of (1.22) and a rating of (average), while item number (8), which was represented in "the belief of some teachers that the use of technology in education may reduce interaction between students within the classroom," came in last place, with an arithmetic mean of (2.75), a standard deviation of (1.15), and an average rating.

This may be attributed to teachers' strong desire to participate regularly in training courses and summer activities, and their lack of fear of disruption or chaos during the use of technology in the classroom. This differs from the findings of the study by [8], which indicated that the level of technological difficulties related to the curriculum was higher.

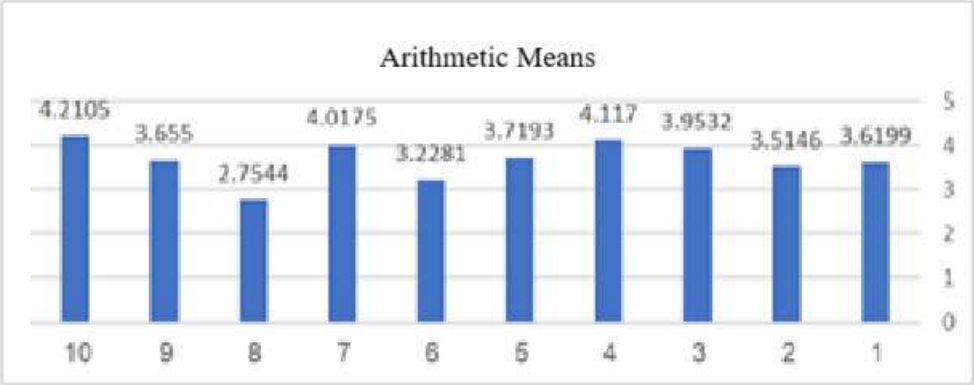

Figure 5: The Arithmetic Means of the Teacher-specific Problems

- **The second aspect: School-specific problems**

The arithmetic means and standard deviations of the school-specific problems as in Table 9.

Table 9: Arithmetic Means and Standard Deviation of School-Related Challenges

No	School-related Problems	Arithmetic Mean	Standard Deviation	Rating	Order
1	The large number of students in each class presents a significant challenge.	4.17	1.07	High	4
2	Consistent maintenance of equipment is limited.	4.13	.890	High	7
3	Some schools lack even the most basic tools required for using technology in the educational process.	4.39	.780	Very High	1
4	Classrooms are rarely suitable for using technology in the educational process.	4.27	.890	Very High	3
5	Consistent follow-up by school administration on teachers' use and integration of educational technology in teaching is weak.	3.80	1.13	High	9
6	A guide or plan to assist teachers in implementing technology in education is scarce.	4.13	.940	High	6
7	The curriculum has not been updated to keep pace with the continuous and rapid development of technology.	4.13	1.07	High	5
8	Insufficient financial support from responsible authorities is available to support educational technology.	4.35	.920	Very High	2
9	Computer labs equipped with computers to assist teachers in using technology in education are rare in some schools.	4.12	1.04	High	8
10	Occasional power outages in some schools prevent the use of computers in the labs.	3.75	1.18	High	10
Total Averages		**4.13**	**0.62**	**High**	

Table (9) shows that teachers' responses regarding school-related technology challenges had an overall average of (4.13) and a standard deviation of (0.62), resulting in a high rating. This indicates that the problems are perceived as being of a high degree from the participants' perspective.

The arithmetic means for the items in this section ranged between high and very high (3.75 – 4.39), with item (3), which reads “Some schools lack the most basic tools necessary for using technology in the educational process,” ranking first with an arithmetic mean of (4.39) and a standard deviation of (0.78) and a very high rating.

This was followed by item (8), which addressed "the lack of sufficient financial support from the responsible authorities for educational technology," with an average of (4.35), a deviation of (0.92), and a very high rating. Then came paragraph (4), which concerned the lack of suitability of classrooms for the use of technology, with an average score of (4.27), a deviation of (0.89), and a rating of (very high).

Item (1), concerning the large number of students in a single class, was presented as a challenge with an average score of (4.17), a deviation of (1.07), and a rating of (high). This was followed by item (7), related to the failure to develop curricula to keep pace with technological advancements, with an average score of (4.13), a deviation of (1.07), and a rating of (high).

Item (5), which deals with "weak school administration follow-up on technology implementation," received an average score of (3.80), a deviation of (1.13), and a rating of (high). In contrast, item (10), which deals with "occasional power outages," received the lowest score among the items, with an average score of (3.75), a deviation of (1.18), and a rating of (high).

This may be attributed to a lack of resources and tools for implementing technology in schools, which aligns with the findings of the study by [2], which indicated the existence of administrative and organizational obstacles that limit the effective integration of technology into the

educational environment. Conversely, recent studies suggest that although teachers have positive attitudes and a high level of interest in using educational technologies, their application in classrooms remains limited and more supportive than strategic, being used more for administrative tasks and research rather than as a core teaching tool [12].

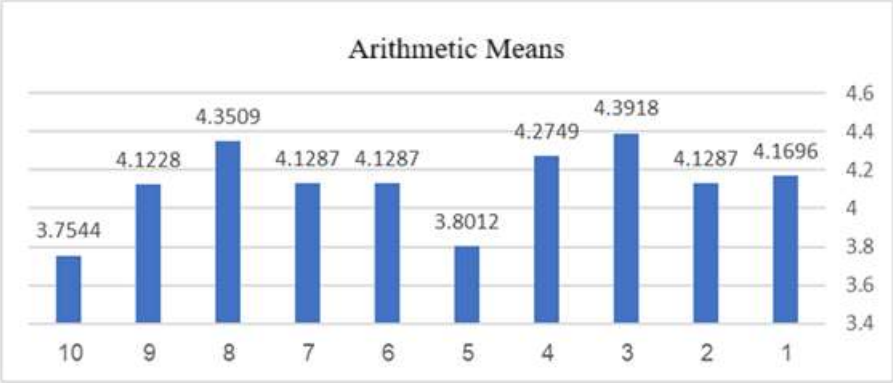

Figure 6: Arithmetic Means for School-specific Problems

Table (10) shows that the problems of technology use in education had a high mean score of (3.90) and a standard deviation of (0.52) across all questionnaire items. This indicates that problems with technology use in education are present and to a high degree within the study population.

Table 10: The Arithmetic Mean and Standard Deviation of the Problems of Technology Use as a whole.

Technology-related Problems	Arithmetic Mean	Standard Deviation	Rating
Overall Problems	3.90	0.52	High

8.1.2 The Second Study Question

"Are there statistically significant differences in the respondents' answers regarding the problems of technology use in public schools in Benghazi that can be attributed to the variables of gender, specialization, educational qualification, and years of experience?"

- **First: According to the gender variable:**

To answer this question and to determine the differences between the responses of the respondents regarding the problems of technology use in public schools in Benghazi from the teachers' point of view, which are attributed to the gender variable, the t-test was used, as shown in the following Table (11).

Table 11: Independent Samples t-test for Differences According to the Gender Variable

Variable	Arithmetic Mean		Sig	Statistical Decision
	Female	Male		
Teacher-related Problems	3.79	4.12	0.22	Not Statistically Significant
School-related Problems	4.08	4.09	0.95	Not Statistically Significant
Overall Problems	3.89	4.11	0.41	Not Statistically Significant

Table (11) shows that the significance level for the t-test for the problems as a whole was (0.41), which is not statistically significant at the 0.05 level. Likewise, the significance level for the T-test for the two sides, the side of problems related to the teacher and the side related to problems related to the school, which means that there are no statistically significant differences between the

responses of the respondents regarding the problems of using technology in public schools from the point of view of male and female teachers that are attributed to the gender variable, and that both males and females believe that the level of problems facing the use of technology by teachers was high, whether from the teacher's or school's side .

- **Second: According to the specialization variable:**
  To answer this question, and to determine the statistically significant differences in the responses of the participants regarding the challenges of technology use in public schools in the city of Benghazi from the point of view of the teachers, which are attributed to the specialization variable, the t-test was used, as shown in the following Table (12):

Table 12. Independent Samples t-test for Differences According to the Specialization Variable

Variable	Arithmetic Mean		Sig	Statistical Decision
	Scientific	Literary		
Teacher-related Problems	3.78	3.83	0.55	Not Statistically Significant
School-related Problems	4.05	4.12	0.51	Not Statistically Significant
Overall Problems	3.88	3.93	0.48	Not Statistically Significant

Table (12) shows that the significance level value of the (T) test for problems is greater than the significance level of (0.05), which means that there are no statistically significant differences between the responses of the respondents regarding the level of problems with the use of technology as a whole according to the specialization variable. They, with their different specializations, see that the problems are high, whether they are related to the teacher or to the school.

- **Third: According to the educational qualification variable:**
  To answer this question and to determine the differences between the responses of the respondents regarding the problems of using technology in public schools in the city of Benghazi from the point of view of the teachers, which are attributed to the educational qualification variable, the t-test was used.

Table 13: The Results of the Independent Samples t-test for Differences According to the Educational Qualification Variable.

Variable	Arithmetic Mean		Sig	Statistical Decision
	Educational	Non-educational		
Teacher-related Problems	3.80	3.82	0.86	Not Statistically Significant
School-related Problems	4.07	4.11	0.69	Not Statistically Significant
Overall Problems	3.89	3.93	0.76	Not Statistically Significant

Table (13) shows that the significance level of the T-test for the problems as a whole is greater than the significance level at (0.05). This means that there are no statistically significant differences between the degree of the presence of technology problems according to the educational qualification variable, and that they all, with their different qualifications, see that the level of problems is high on both sides (teacher side) (school side).

- **Fourth: According to the years of experience variable:**
  To answer this question, an ANOVA test was calculated to test the differences in technology use problems in public schools in Benghazi from the teachers' point of view, according to the variable of years of experience, as shown in the following Table (14):

Table 14. ANOVA test for Differences by Years of Experience

Variable	Arithmetic Mean			Sig	Statistical Decision
	Less than 5 years	5–10 years	More than 10 years		
Teacher-related Problems	3.92	3.82	3.79	0.17	Not Statistically Significant
School-related Problems	3.09	4.15	4.07	0.86	Not Statistically Significant
Overall Problems	3.98	3.94	3.89	0.79	Not Statistically Significant

Table (14) shows that the significance level for the (ANOVA) test for the problems as a whole is greater than the significance level at (0.05), which means that there are no statistically significant differences between the degree of technology use according to the variable of years of experience, and it differed from the study of [25], which was based on the fact that there are statistically significant differences according to the variable of years of specialization.

1. There are problems facing the use of technology in public schools, from the perspective of teachers, and these problems are generally high on both the teacher and school sides.
2. There are no statistically significant differences in the respondents' assessments of the challenges associated with technology use in public schools, from the teachers' perspective, attributable to the variables of gender, specialization, educational qualification, and years of experience.
3. There are no statistically significant differences greater than 0.05 based on the variables of gender, specialization, and educational qualification regarding the problems of technology use.
4. There are no statistically significant differences greater than 0.05 according to years of experience in respondent perception of the problems of technology use in public schools.

9.DISCUSSION OF RESULTS

The results of this study indicate that the challenges associated with integrating technology into education have been broadened and deepened, as evidenced by the high overall average (M = 3.90). This result indicates that these difficulties are not seen as isolated cases, but rather as deep-rooted and persistent obstacles that have been affected in educational practices [15]. Previous studies have reached similar conclusions, confirming that inclusion challenges are systemically shaped and have emerged in multiple educational contexts, particularly in developing environments [10;19].

At the teacher level, a clear gap in professional development and support was identified. A high level of the lack of training opportunities index was observed (M = 4.21), indicating that teachers were not adequately equipped to effectively employ technology in the classroom. This result is consistent with a recent study published in 2024, which stressed the importance of teachers' preparedness and continuous professional development for successful technology integration in education [30]. Accordingly, traditional teaching methods still prevail (M = 3.72), while limited application of technologically enhanced classroom activities is made (M = 4.12). This result is consistent with what [11] indicated, which showed that primary school teachers face a range of obstacles that limit technology integration practices, and that the lack of training, weak professional support, and the need to develop digital competencies are among the factors affecting the effective use of technology in classroom environments.

It has been documented in the literature that the lack of training and weak professional development is considered among the most prominent obstacles that stand in the way of effective technology integration [13;15;10;19]. In theory, the TPACK model asserts that effective integration is not achieved merely by the availability of tools, but requires the integration of technological, educational, and content knowledge [20; 24]. This view has been reinforced in numerous studies [22; 19].

At the school level, additional obstacles of a structural nature were recorded. A significant deficit in basic technological resources was found (M = 4.39), along with a clear weakness in financial funding (M = 4.35), in addition to the unsuitability of classroom environments (M = 4.27). These

indicators suggest that the integration process has been hampered by structural and institutional factors. Applied studies have demonstrated that weak infrastructure, limited funding, and insufficient institutional support remain among the most significant obstacles to technology integration [15;10;19]. [3] also confirmed that the level of employing educational technology in schools is related to the availability of material and organizational requirements that support the educational process. These results align with a recent study published in 2026, which showed that limited resources and technical support are among the major obstacles teachers face when integrating technology into teaching [32].

Weak administrative follow-up and the absence of organized implementation plans have been interpreted as contributing factors to the complexity of the integration process. This can be viewed through the lens of systems theory [9], where educational outcomes are considered the result of the interaction of a set of interconnected elements such as resources, policies, and human capabilities.

Also, an important aspect of the results are no statistically significant differences were observed between the demographic variables (gender, specialization, type of qualification, years of experience), which indicates that integration difficulties may be similar among all teachers without any substantial difference. This finding has been supported by the literature, which emphasizes that institutional and structural factors are more influential than personal factors [19].

However, the finding of no statistically significant differences among the sample members based on demographic variables must be interpreted with caution, given the limitations of the sample. This result may indicate that the challenges of technology integration are similar across teachers and stem more from factors related to the educational environment than from their individual skills. Nevertheless, this does not imply that demographic variables have no impact on technology integration within the educational process.

Also, the disparity in the distribution of the sample members, especially according to the gender variable, may have affected the absence of differences between the groups. Therefore, this result should be interpreted within the context of the current study, and cannot be considered conclusive evidence that individual characteristics of teachers have no effect.

In general, the results indicate that a balanced and integrated approach to integrating technology into education is needed. Achieving genuine transformation cannot be accomplished simply by providing tools; it requires ongoing professional development. This element has been identified as fundamental to successful integration [13;15;10; 19; 22].

Based on this, the need for a comprehensive and structured framework became clear. The proposed framework was developed as a direct response to these findings, framing the challenges as interconnected dimensions that contribute to promoting effective and sustainable technology integration.

In this framework, empirical evidence and theoretical references were used, which led to the presentation of an applied approach that takes into account the reality of the educational environment and answers its challenges in an integrated manner.

In light of the nature of the data used in the current study, the results must be viewed as reflecting teachers' opinions about the challenges of integrating technology into teaching methods, and it does not represent a direct measurement of the actual reality of classroom infrastructure and practices. Therefore, the high averages of some challenges related to equipment, training, and institutional support are expressed in the extent of teachers' awareness of these challenges. challenges, but it does not necessarily determine their actual size. Future studies could incorporate additional tools—such as classroom observation and direct assessment of technological infrastructure in schools—to gain a more comprehensive understanding of these challenges.

10. THEORETICAL JUSTIFICATION AND PROPOSED FRAMEWORK FOR TECHNOLOGY INTEGRATION IN EDUCATION

10.1 Theoretical Justification

The proposed framework was developed through a systematic and conscious integration of empirical results with a selected set of theoretical perspectives. The selection of these theories was

based on the nature of the challenges identified in the study, along with the need to address technology integration at both the teacher and educational institution levels simultaneously.

The Educational Technology Content Knowledge (TPACK) model [20; 24] was adopted because it provides a comprehensive explanation of how technology can be effectively integrated into teaching through the interaction between technological and educational knowledge and the content of the subject. This model is directly related to the challenges faced by teachers that emerged in the results.

The results showed a high level of teacher-related problems (M = 3.68), with the highest average recorded for the lack of training courses (M = 4.21), followed by the weak availability of classroom activities supporting technology integration (M = 4.12), and then the continued reliance on traditional methods. Traditional teaching methods (M = 3.72).

These data indicate a clear gap in teachers' ability to integrate technology into their teaching practices. This finding aligns with previous studies that addressed the obstacles to technology use in various educational settings. [14] study demonstrated that limited training and available resources hinder computer use in teaching. [16] study also pointed to a lack of training, technical support, and equipment as key challenges for teachers in integrating educational technology. Similarly, [29] study showed that weak professional development programs and certain organizational and technical obstacles impede teachers' ability to effectively use technology in the educational process.

These findings align with those of [7], who indicated that teachers' use of educational technology is linked to their technological skills and the availability of training and professional development opportunities. This underscores that teacher preparation and competency development are essential requirements for the effective integration of technology in education. Furthermore, [17] demonstrated that teachers' readiness for technology-assisted teaching is linked to a range of factors, most notably digital literacy, prior experience, and the level of support available in the educational environment. This suggests that successful technology integration requires developing teachers' capabilities alongside providing a supportive institutional environment.

Accordingly, the TPACK model was used as a basis for designing the **capacity building dimension** and transforming its components into integrated training activities and professional development programs. This choice is consistent with the results of [28], which showed a positive relationship between teachers' self-efficacy in integrating information technology and their level of mastery of TPACK components, which supports the importance of developing teachers' knowledge and skills to use technology more effectively. Furthermore, the model was used to guide the **integration and strategic planning dimension**, ensuring that technology use was linked to educational objectives and curriculum content [31], without isolating it from the educational context. This approach is consistent with the principles of educational planning, which emphasize that the success of any development process requires identifying needs, formulating clear goals, and systematic planning that links resources, activities, and follow-up and evaluation processes, ensuring the sustainability of improvement and development [21].

In contrast, while the TPACK model focuses on teacher competencies, it has been shown that a significant portion of the challenges lie within the broader educational environment. Therefore, systems theory [9] has been adopted to provide a comprehensive structural perspective. The results related to schools showed a high overall average (M = 4.13), with high levels of deficiencies in basic technological tools (M = 4.39), weak financial funding (M = 4.35), and unsuitable classroom environments (M = 4.27). These results show that technology integration cannot be achieved simply by enhancing teachers' capabilities but requires a comprehensive and integrated framework that includes infrastructure, institutional support, and administrative coordination. Accordingly, systems theory was adopted to reinforce the **infrastructure and support** dimension within the proposed framework.

Systems theory was also employed in shaping the overall structure of the framework, which is considered as an interactive and dynamic system. This is evident in the design of the implementation mechanism as a sequential cycle consisting of diagnosis, planning, preparation, implementation, and evaluation. These stages align with system components such as inputs, processes,

outputs, and feedback, making the framework more akin to an integrated and adaptable system.

In addition, this framework is based on empirical data, where it was not limited to describing the problem only, however the study results were used to shape the structure of the framework itself. Each dimension was extracted from specific indicators that appeared in the results, such as weak guidance for the use of technology (M = 4.13) and the lack of alignment between curricula and technological developments (M = 4.13), which led to the inclusion of the **integration and strategic planning** dimension.

Similarly, the weakness of administrative follow-up (M = 3.80) has contributed to reinforcing the need to include a a dimension dedicated to evaluation and feedback, to ensure the ongoing improvement processes and continual follow-up.

In conclusion, it is clear that the absence of statistically significant differences between demographic variables indicates that these challenges appear frequently and consistently among different categories of teachers. This reinforces the conclusion that the problem is not individual, but rather systemic in nature, which supports the reliance on both the TPACK model and Systems theory in designing the proposed framework.

10.2 Proposed Framework

Based on the integration of theoretical frameworks with empirical results, the proposed framework was structured as five interrelated dimensions. Each dimension is expressed as a direct application of the study's outputs to a specific intervention area.

The **Diagnostic Dimension** is the starting point in the framework, as it was derived from the high general level of technology-related challenges (average = 3.90), in addition to the observed variation in responses across individual items (2.75–4.39). This dimension emphasizes the importance of continuous, data-driven assessment to identify needs and prioritize interventions.

The **Infrastructure and Support Dimension** was directly derived from the most prominent challenges at the school level. This dimension was included in the framework as a result of the high mean scores associated with the lack of basic equipment (average 4.39), weak financial support (M = 4.35), and the unsuitability of classroom environments (average 4.27). This dimension highlights the importance of preparing a supportive environment that helps teachers to use technology effectively.

The **Capacity Building Dimension** is derived from key teacher-related indicators and is based on the TPACK model. The lack of training (M = 4.21) and the limited classroom activities (M = 4.12) have been transformed into a structured professional development methodology that integrates technological, pedagogical, and content knowledge.

Regarding the **Dimension of Integration and Strategic Planning**, it was developed in response to the weakness of organized implementation practices. The lack of guidance (M = 4.13) and the lack of coherence between curricula (M = 4.13) were directly reflected in this dimension, where the focus is on the integration of technology within curriculum planning and teaching methods.

The **Evaluation and Feedback Dimension** was derived from the weaknesses identified in the context of administrative follow-up (M = 3.80). It presents a set of systematic evaluation mechanisms and performance indicators that support continuous improvement.

Overall, these dimensions are formed into an interconnected and integrated framework, whereby each dimension addresses a specific aspect of the challenges, while simultaneously contributing to the development of a comprehensive methodology for technology integration.

10.3 Framework Implementation and Evaluation

To transform the proposed framework into a practical application, an iterative implementation mechanism was designed, reflecting its theoretical foundations and empirical principles. This mechanism activates the framework through five interconnected stages.

The diagnostic phase is derived from the overall level of challenges (M = 3.90) and focuses

on identifying needs through systematic data collection and analysis.

The planning phase is based on a lack of structured guidance and weak curriculum alignment (M = 4.13), during which priorities are identified, and strategic plans are developed to meet the needs of teachers and educational institutions.

The preparation phase was designed as a direct response to the challenges related to infrastructure, particularly the lack of basic equipment (M = 4.39) and weak financial support (M = 4.35), thus ensuring the creation of suitable conditions for implementation.

Regarding **the implementation phase**, the focus will be on addressing the challenges related to teachers, particularly the lack of training (M = 4.21) and the continued reliance on traditional teaching methods (M = 3.72), by supporting the practical application of technology within classrooms.

The evaluation phase was designed to address weaknesses in administrative follow-up (M = 3.80), and it presents a set of indicators to measure performance and assess the effectiveness of the framework.

These indicators were derived directly from the study results. Teacher indicators measure their level of participation in training and professional development, while usage indicators assess the extent of technology integration in classroom practices. The availability of resources is determined through infrastructure indicators, and improvements in processes are measured through impact indicators. Learning and teaching.

The principles of systems theory are embodied through the cyclical relationship between these stages, whereby subsequent diagnostic activities are continuously guided by the results of the assessment, thus ensuring the framework's continued adaptability and sustainability over time.

The absence of statistically significant differences between demographic variables enhances the possibility of applying the framework in diverse educational contexts. Given the similarity of the challenges observed among categories of teachers, the framework has a great capacity for expansion, particularly in government school systems that face similar circumstances.

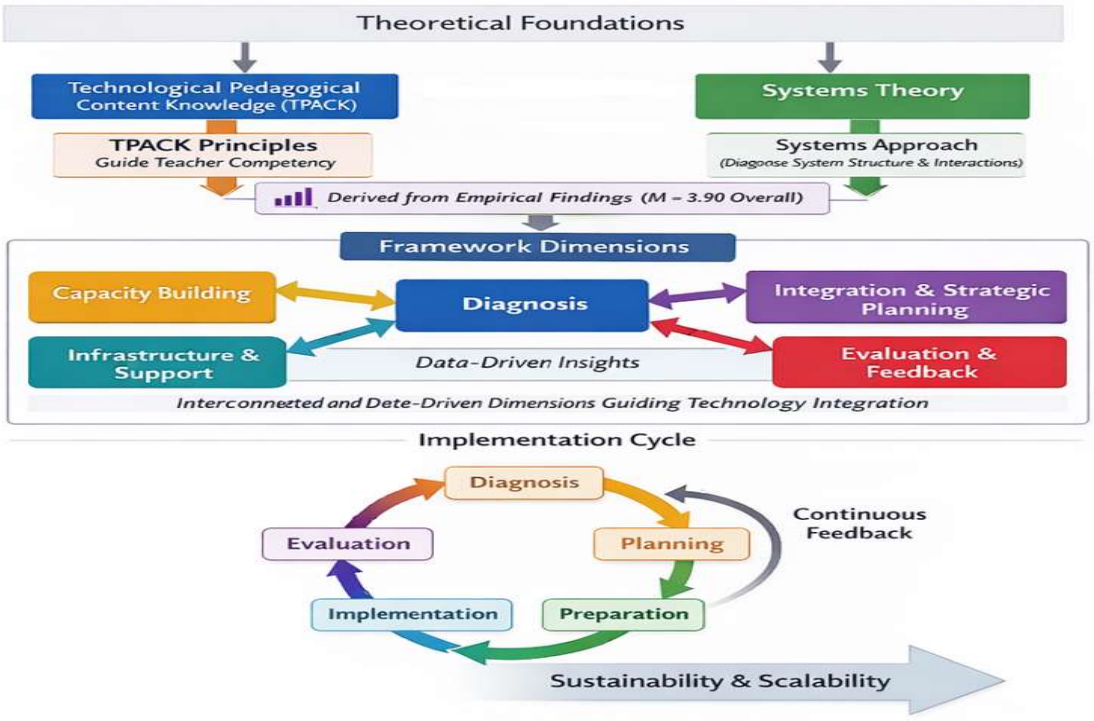

Figure 7: Conceptual Framework for Technology Integration in Education

Figure (7) shows the proposed framework for technology integration in the form of a multi-layered model, in which the theoretical foundations are linked to experimentally derived dimensions and the iterative implementation mechanism. The arrows in the figure are not merely visual representations, but rather represent relationships based on theoretical frameworks and data.

At a deeper level, this framework relies on two complementary theoretical perspectives, namely the TPACK model and systems theory, where the arrows extending from these theoretical foundations towards the dimensions of the framework show how each contributes to guiding design decisions.

The arrow extending from the TPACK model to the **Capability Building** dimension represents a direct translation of the model's components into practice. This correlation is supported by empirical data, particularly the significant increase in training deficiencies (M = 4.21) and the limited scope of classroom activities (M = 4.12). These indicators reflect a gap in the integration of technological, pedagogical, and content knowledge, which lead to the development of this dimension as a structured response.

Similarly, the arrow extending from the TPACK model to the dimension of **Integration and Strategic Planning** expresses the application of the model at the educational level. The lack of clear guidance for technology use (M = 4.13) and the lack of curriculum alignment (M = 4.13) indicate that technology has not yet been fully integrated into educational practice. These findings contributed to directing this dimension towards linking technology to curriculum planning, treaching practice and instructional design.

As for the extensions from systems theory, they have embodied their role in constructing the framework as a coherent system. The correlation with the **Infrastructure and Support** dimension was supported by high indicators of a lack of basic tools (mean = 4.39), weak funding (mean = 4.35), and unsuitable classroom environments (mean = 4.27). These results showed that technology integration depends on systemic conditions, which necessitated the inclusion of this dimension is considered a fundamental structural component.

The **Evaluation and Feedback** dimension is further supported by systems theory, as illustrated by the arrow connecting them. This connection was based on the need to address shortcomings in administrative follow-up (M = 3.80) and to activate continuous monitoring tools, as the evaluation results contribute to supporting ongoing improvement efforts.

At the center of the plan, the five dimensions of the framework (**Diagnosis, Capacity Building, Infrastructure and Support, Integration and Strategic Planning, and Evaluation and Feedback**) overlap, indicating that they operate within an integrated system rather than as separate elements. The interrelationships between these dimensions reflect the picture of the correlation that has been observed experimentally, as the challenges related to teachers are intertwined with those related to schools and influence each other.

The lower part of the figure illustrates the **implementation cycle**, represented by a circular flow linking the stages of diagnosis, planning, preparation, implementation, and evaluation. The arrow extending from the dimensions towards this cycle indicates that it is activated through these stages. Each phase was linked to specific empirical indicators, where the diagnostic phase is based on the overall high level of challenges (average = 3.90), while the preparation phase reflects the lack of infrastructure (M = 4.39), and the implementation phase addresses training gaps (M = 4.21).

The circular arrow returning from the evaluation phase to the diagnosis phase embodies the principle of continuous feedback and system adaptation, a fundamental principle based on systems theory, which ensures that the framework remains vital and adaptable to changes.

Finally, the extended arrow towards **sustainability and scalability** expresses the absence of statistically significant differences between demographic variables, indicating that the identified challenges are systemic and consistent across teacher categories, and this supports the possibility of applying the framework in educational contexts.

10.4 Differences from Previous Studies

The results of the current study are consistent with a number of previous studies in identifying the most prominent challenges facing the integration of technology in education. These include lack of training, weak infrastructure and institutional support, and continued reliance on some traditional educational practices. However, the current study is not limited to identifying and

describing these challenges, rather, the field results are primarily used to construct a proposed framework that links teacher-related challenges with school-related challenges within an integrated Conceptual Framework.

The current study is also characterized by linking its results to two complementary theoretical frameworks, namely the TPACK model and systems theory, so that the first contributes to explaining Aspects related to teacher competencies and integrating technological, pedagogical, and content knowledge, while providing systems theory A broader perspective to understand the role of infrastructure, support, planning and follow-up in the integration process. Accordingly, the findings were translated into five interconnected dimensions and an implementation framework, thereby shifting the study from merely diagnosing challenges to presenting a structured approach for addressing them.

10.5 Limitations and Future Research

The results of the study are subject to some methodological limitations that must be taken into account when interpreting them. The study was limited to preparatory stage teachers in a group of government schools in the city of Benghazi, and there was an imbalance in the distribution of the sample according to some demographic variables, especially the gender variable. In addition, the study relied on teachers' responses as the main source of data. Therefore, the results should be interpreted within the context of the study, its sample, and the data collection tool.

There remain aspects that require further research, the most important of which are testing the proposed framework in the field and measuring the impact of its application on teachers' practices and teaching and learning processes, and examining its suitability for different educational stages and schools. Future studies can also apply the framework to more diverse and balanced samples to evaluate its effectiveness and explore its applicability in other educational environments.

11. CONCLUSION

This study identified two main groups of challenges that affect technology integration in public schools in the city of Benghazi, namely: challenges related to teachers and challenges related to schools. The results showed that insufficient training and limited support were among the most prominent challenges at the teacher level, while other challenges emerged at the school level were limited technological resources, lack of funding, and inappropriate classroom environments. The absence of statistically significant differences attributable to gender, specialization, qualifications, or years of experience also indicates that these challenges are mostly of a structural (systemic) nature, and are not limited to specific groups of teachers.

In response to these findings, the study proposed an implementation framework consisting of five key dimensions: diagnosis; infrastructure and support; capacity building; integration and strategic planning; and evaluation and feedback. This framework was developed based on the study's findings, drawing theoretically upon the TPACK model and systems theory; it aims to link teacher capacity building with institutional support, infrastructure, strategic planning, and continuous assessment, all within an integrated approach to technology integration. The main contribution of the study lies in moving beyond the stage of identifying the challenges associated with technology integration towards translating empirical results into a structured framework to address them; By linking the factors related to teachers and those related to the school within one framework, the study provides a basis for supporting the integration of Technology in the educational context examined in this study.

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Use of Artificial Intelligence

The authors declare that they used artificial intelligence techniques for limited purposes related to linguistic editing and improving wording only, through the ChatGPT tool, without this having any impact on the scientific content, results, or interpretations contained in the study.

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