RICHTMANN PUBLISHING

Research Article

Received: 27 March 2024 / Accepted: 30 May 2024 / Published: xx July 2024

The Role of Digital Learning Innovations in Achieving Good Digital Education for Teachers in Saudi Arabia

Omar Abdullah Omar Alshehri[1]*

Ahmad Mohammad Aldaleel[1]

Elrasheed Ismail Mohommoud Zayid[2]

[1]Educational Technology Department,
College of Education and Human Development,
University of Bisha., Bisha 61922,
Saudi Arabia
[2]Information Systems Department,
College of Computing and İnformation Technology,
University of Bisha, Bisha 61977,
Saudi Arabia
**Corresponding Author*

DOI: https://doi.org/10.36941/jesr-2024-0098

Abstract

The study aimed to determine the effectiveness of digital learning innovations (DLIs) in achieving good digital education among intermediate school teachers (ISTs) in the Al-Namas Governorate. The study included 400 teachers from all disciplines of public education, consisting of 218 female and 182 male teachers. The professional ranks of participants comprised 286 practicing teachers, 66 teachers, and 48 with other ranks. The study identified that 255 participants did not receive training on DLIs. Statistically significant differences between the genders were found at the significance level (α≤0.05), in favor of female teachers in problem-solving and data analysis. A one-way ANOVA test and Cronbach's alpha were used to measure the statistically significant differences between different variables. The average Cronbach alpha coefficient was 0.986, which is a high value indicating that the questionnaire has a high degree of stability. The study results demonstrated that the transactions of artificial intelligence, innovative educational activities that meet the needs of people with special needs, and cybercrime require intensive and in-depth training so that teachers can optimally use digital innovation applications in the educational environment.

Keywords: *Digital learning Innovation, teacher innovation skills, Saudi teachers' innovation, the effectiveness of the innovation program*

1. Introduction

DLIs are a vital core in a technologically advanced world, reflecting a tremendous evolution in how we think and design solutions and innovations (Habal, 2024). DLIs represent a paradigm shift in how we interact with technology to improve our lives, facilitate many services, and achieve a competitive

edge (Alexandro & Basrowi, 2024).

DLIs are manifested in the use of modern technologies and smart solutions to solve complex challenges and achieve progress in various fields (Shwedeh, 2024). DLIs contribute to positive transformations, opening a new horizon for creative possibilities and success in the digital age (Ciarli et al., 2021).

In this context, DLIs are vital for teachers to react effectively to this accelerated digital transformation. DLIs include the ability to think creatively to use technical knowledge skills, understand and use technology effectively, configure and implement digital solutions to improve processes, collect, organize, and analyze data effectively, and achieve effectiveness by having useful digital communication skills (Majrashi, 2023; Alexandro & Basrowi, 2024; and Habal, 2024).

The goals of promoting DLIs for teachers can be written as 1) completing the objectives of traditional education and opening new opportunities for the learner (Al-Shebel, 2021); 2) increasing the level of interaction between the learner and the scientific content of educational materials and creating a learning environment for the learner that overcomes the constraints of time and space in facing life's challenges (Motorga, 2023). 3) Taha (2023) argued that using DLIs develops self-motivation to learn and solve the issue of the shortage of basic educational staff and educational institutions, delivering the educational content in the form of an audio, video, or written presentation, and allowing the learner to choose the method of his choice in the presentation and saving time and effort 4) Al-Shamrani (2019) emphasized that DLIs can help teachers create a more interesting learning environment, encourage students to learn and participate, and improve the quality of education and its outcomes. Therefore, designing an effective training program to develop the DLIs of the teachers is one of the most important strategies through which the quality and outcomes of education can be improved, and students can be prepared for the future.

Few studies employ adaptation to encourage teachers' innovation factors; nevertheless, to the best of the authors' knowledge, none of the literature review's considerations took ISTs in the Al-Namas Province's innovation factors into account. In this study, we carried out an extensive innovation evaluation for a sample dataset representing ISTs in Al-Namas Province. Commonly used innovation variables were categorized into five different fields (i.e., technical knowledge skills, digital security awareness, collaboration and communication skills, problem-solving skills, and data analysis).

2. Study Problem and Questions

The problem arose when the authors noticed the scarcity of the use of digital innovation applications in the educational environment during their participation in teaching the digital skills course in the Optimal Investment Program for Educational Personnel. This program was launched by the Saudi government to develop male and female teachers at all levels of public education and provide them with the opportunity to teach in new scientific specializations that aim to develop education and support its distinction, quality, and global competition to achieve the Kingdom's Vision 2030.

This study aims to contribute to the latter objective as well as resolve the contradiction that I have observed in the classroom between the heavy reliance of teachers on new technologies in their daily lives and the little use of these tools for learning. As a starting point, the current study focuses on teachers. More specifically, it seeks to uncover the role of DLIs in achieving the goals of digital education among ISTs in the Al-Namas Governorate in KSA to support learning. In addition, this study would supplement and expand the still relatively small body of research on the use of DLIs in Saudi education.

This study poses the following research questions:

1. What is the role of DLIs in achieving good digital education among ISTs in the Al-Namas Governorate?
2. What digital skills do ISTs in the Al-Namas Governorate need to develop?
3. To what extent is the idea of providing a training program that supports the DLIs of ISTs

considered?

4. Are there any statistically significant differences, at the level of significance (α≤0.05), between ISTs' responses towards the degree of availability of DLIs in teaching, due to the variable's gender, specialization, professional rank, and 'attendance of training courses?

3. Literature Review

DLIs are described as the product or output of the innovation process, where this output or product is embodied by digital or information technologies. DLIs can be a new idea or improvement of something that already exists, including products, services, business models, or otherwise (Majrashi, 2023).

Joosten et al. (2020) define DLIs as either a scalable solution to bridge known gaps in student learning and challenges or a process of developing and adopting digital courses. In the same vein, Wang, Meng, and Butler (2015) define DLIs as "... a new idea, practice, or thing perceived as new, embedded in, and enabled by digital technologies.

These definitions highlight the importance of digital technology in the context of innovation, as digital transformations are an essential part of these processes and contribute to change and improvement in multiple areas. DLIs can include digital learning programs, basic learning techniques, or solutions based on practical design. Faculties and educational institutions can implement these innovations to improve student access or learning processes, whether using technology to enhance educational effectiveness or adopting new methods based on innovation in course design.

The Saudi National Vision 2030 placed a high priority on DLIs development for teachers, and it is becoming more important in various areas of study on educational quality (Ciarli et al., 2021). Numerous studies on the development and measurement processes of DLIs have been conducted by researchers due to the urgent necessity to promote them (Budnyk et al., 2021). DLIs have become the main tool for improving education quality, streamlining the learning of new knowledge, and updating instructional frameworks (Davis, 2022).

Habal (2024) indicated the importance of DLIs in the face of the growing challenges and expectations of beneficiaries; as well as a great desire to promote DLIs. Despite the importance of DLIs, there is a lack of processes dedicated to it, which must be human-centered, and aim to achieve innovative digital solutions and quality in the user experience. In this context, students can access educational content at any time and from anywhere, making learning more flexible and relevant to the needs of the individual (Majrashi, 2023). Davis (2022) indicated that schools crucially need a culture of engagement to improve their learning performance and create virtual communities and communities of practice among teachers, not just as an instructional strategy to be used with students.

Albahiri & Alhaj (2023) carried out a study to investigate how well-prepared male and female instructors are for integrating DLIs into the classroom. 768 educators were selected at random from the public schools in the Saudi Arabian Asir region. Using SPSS, the collected data was statistically evaluated, and the findings were shown in both descriptive and inferential formats. Because the overall mean of the t-test was 23.471, it was proven that male instructors have very little experience using computers for professional development. The findings show that prospective female teachers at training institutions require a training program since there are gender disparities in instruction, technical support for schools, and future development.

Kryukov & Gorin (2017) analysed using digital technology-based education innovations in higher education in Russia. They demonstrated that extensive implementation of digital technologies in universities is the main factor conditioning the acceleration of innovative changes in educational processes. In contrast, digital technologies themselves have become one of the key mechanisms for creating competitive advantages between educational institutions in the market for educational services.

Singh, Alshammari, and Singh (2021) developed a framework depicting the impacts of digital technology-enabled personalized and adaptive learning on student learning performance in Saudi Arabia. The results indicated that innovative personalized and adaptive learning can foster student creativity, enhance their learning performance, improve teaching-learning methodologies, bridge the gender divide, increase professionalism, improve evaluation methods, and streamline curriculum.

Joosten et al. (2021) stated that DLIs have the potential to improve instruction and learning effectiveness by facilitating effective pedagogies and improving efficiency in higher education. However, some faculty are still reluctant to invest the time to adopt these solutions.

Various studies have discussed the significant elements of technical knowledge that teachers should know, including the ability to use appropriate digital applications to communicate educational content and design interactive learning activities (Turner, 2020), knowledge of the use of artificial intelligence applications in education (White, 2021), and the ability to design innovative educational activities that meet the needs of people with special needs (Clark, 2022). However, Zain (2021) clearly stated that adherence to usage policies and respect for privacy, understanding the usage policies of digital services, respect for intellectual property rights, and information privacy are essential.

Many studies have explained that DLIs have many advantages, including providing a variety of learning methods such as audio, image, and video, which contribute to meeting the diverse needs of learners and help them better understand concepts (Al-Shamrani, 2019); quick and easy access to multiple online resources anytime, anywhere, and absorb a large amount of information (Alenezi, 2023); and making learning fun and reducing boredom caused by traditional methods (Al-Shebel, 2021). These studies added a positive contribution by promoting youth innovation and creativity in the local community, realizing Saudi Vision 2023, and effectively strengthening the value of and utilization of new educational technology in education.

In contrast, many studies argue that DLIs face many obstacles that affect their spread and success, the most important of which is infrastructure, which includes providing appropriate devices for DLIs and providing a safe and stable learning environment (Wahiba Abdul Rahim, 2019; Kumari & Naaz, 2020); the high cost of DLIs constitutes an obstacle to its spread in some educational institutions (Taha, 2023).

Social acceptance is another prevalent issue, as there is still some reluctance to accept DLIs among some learners and parents. Some reasons for this are a lack of understanding of the nature of this type of education, a lack of awareness of the benefits of DLIs, a fear of its ineffectiveness, and a fear of losing teacher-learner interaction (Alenezi, 2023).

Based on our review of the literature, no study has been created to assess and offer a training program for DLIs in improving teachers' innovation skills across Alnamas region. Digital invention skills per teacher can be enhanced via the use of sophisticated training courses and digital technology extracts. Also, the lack of a standardized system could be used for evaluating the effectiveness for teachers' digital innovation elements encouraged us to introduce this quite in-depth, useful work.

To address these obstacles, a range of measures must be taken, including the development of digital infrastructure in educational institutions, training teachers on the use of DLIs, providing high-quality digital educational content, reducing the cost of DLIs, and spreading awareness of the benefits of DLIs.

4. Methodology

4.1 Dataset

The authors chose a quantitative method, more specifically a web questionnaire, for data collection. The questionnaire was created considering existing literature on the topic and the study's setting. Before conducting the survey, the questionnaire was submitted to three scholars for a concise review. It was based on Likart's scientific scaling mechanism for different questions. The research fields were

prepared and set into forty-four questions, forming an online Google questionnaire, which was distributed via email, WhatsApp, and a live poll.

The population of this study was ISTs affiliated with the Education Department of Al-Namas Governorate in southwestern KSA. 400 teachers from the general education staff participated in the survey. It ranked male and female general education teachers participating in the questionnaire, categorized as 218 females, representing 54.5%, and 182 males, representing 45.5%. Their professional rank as practicing teachers was 286 male and female teachers, at a rate of 71.5%, and 66 of them had the rank of teacher; however, the rest had other ranks. 94 of the participants were mathematics majors, at a rate of 23.5%, followed by Islamic education, at 75, at a rate of 18.8%, and then Arabic language, at 70, at a rate of 17.5%. The study also shows that 255 of the study participants (63.7%) did not receive training in DLIs.

The questionnaire link was sent to participants who responded and consented to completing the questionnaire. None of the responses obtained were ruled improper or invalid due to the nature of the questions included in the questionnaire, all of which were necessary for completion (participants could not move to the next section without first completing the current one).

5. Cronbach Alpha Stability Coefficients for Study Variables

Cronbach alpha stability coefficients for study variables mean that the results of the tool are always constant and like the same sample. This has been confirmed by using the scale Cronbach's alpha equation which is usually used to measure the stability of the research tool. The main objective of this analysis is to ensure that the same data is obtained when re-studying, using the same study tool under the same conditions.

The average value of the stability coefficient of the study instrument (Cronbach alpha coefficient) was (0.986), which is a high value, as this percentage exceeds the statistically acceptable percentage of (0.70), which indicates that the questionnaire has a high degree of stability and can be relied upon in the field application of the study.

5.1 Sincerity of the Internal Consistency of the Study Tool

The validity of internal consistency is a test to measure the extent to which the score of each test item correlates to the overall score of the axis to which the statement belongs. After confirming the apparent honesty of the research tool, the researcher applied it in the field to the study sample consisting of (400) teachers, to identify the extent of internal consistency of the research tool and the data of the exploratory sample. The authors calculated the Pearson correlation coefficient to find out the internal honesty of the questionnaire, where the correlation coefficient was calculated between the degrees of each of the statements of the resolution, with the total degree of the axis to which the phrase belongs. It is known that the value of the correlation coefficient ranges between -1 and 1, and the closer its value is to 1. This indicated the strength and positivity of the relationship, and the results were as shown in the following table (1):

Table 1: Internal consistency through Pearson's correlation coefficients for axis statements with the total degree of the axis

The First Axis				The Second Axis			
Ferry	Link	Ferry	Link	Ferry	Link	Ferry	Link
1	0.710	8	0.848	1	0.819	8	0.881
2	0.773	9	0.794	2	0.754	9	0.859
3	0.683	10	0.816	3	0.681	10	0.873
4	0.623	11	0.843	4	0.868	11	
5	0.760	12	0.857	5	0.899	12	
6	0.833	13	0.782	6	0.863	13	
7	0.847	14	0.750	7	0.879		

Third Theme		Fourth Theme				Fifth Theme	
Ferry	Link	Ferry	Link	Ferry	Link	Ferry	Link
1	0.822	1	0.889	7	0.899	1	0.874
2	0.869	2	0.886	8	0.884	2	0.887
3	0.888	3	0.895			3	0.916
4	0.896	4	0.910			4	0.928
5	0.880	5	0.902			5	0.887
6	0.889	6	0.899			6	0.827

It is clear from Table (1) that the values of the correlation coefficient of each of the phrases with their axes are positive and statistically significant at the level of significance (0.01) or less. The values of the correlation coefficient ranged in the degree of use of ISTs in the Al-Namas Governorate for the DLIs of Al-Namas between (0.71) and (0.928) for all axes. This confirms the sincerity of the consistency of the tool's phrases and their interconnection with the axis to which they belong.

5.2 The stage of judgment or verification of the validity of the tool

In this study a five-point Likert scale was used to correct the responses of the research sample, where a score of (1) is given for the response Strongly Disagree, a score of (2) is given for the response Disagree, a score of (3) is given for the response Neutral, a score of (4) is given for the response Agree, and a score of (5) is given for the response Strongly Agree.

The response range was calculated and equals the highest score minus the lowest score and then divided by the number (5) as follows:

- Response range for the statement (5 - 1) = (4).
- Category length, response range, divided by the number of response categories and equals (5 ÷ 4) = (0.8). Then this value is added to the lowest value in the questionnaire, which is (1) true, to determine the upper limit for this cell, where the weighted averages can be determined for the study. Therefore, the standard for judging the values of weighted arithmetic averages and normalization values for the averages were: Strongly Disagree (1-1.8); Disagree (> 1.8 – 2.6); Neutral (>2.6-3.4); Agree (>3.4 – 4.2); Strongly Agree (>4.2 - 5.0).

6. Results and Discussion

6.1 First question answer

What is the role of DLIS in achieving good digital education among ISTs in the Al-Namas Governorate?

To answer this question means (M), standard deviations (SD), and ranking of the responses of the research sample were calculated on the statements of each axis. The general M and the SD of the total score for each axis were also calculated, and the results were as follows:

6.2 The technical knowledge skills of teachers

It is clear from Table (2) that the fourth item obtained the highest average on this axis (agree), with an average of 4.5 of those who participated in the study, thus becoming the best skill enjoyed by teachers in the first axis. Item 5 received the highest rejection rate of 31.5% of this axis, and the overall opinion is neutral, with an average of 3.3 of those who participated in the study, thus becoming the least skill mastered by teachers.

The results also show that the overall opinion of this axis is (agree), with an average of 4 of those who participated in the study. The results of this study suggest that well-designed DLIs that incorporate multimedia resources, interactive activities, and opportunities for collaboration play a crucial role in determining the effectiveness of digital learning experiences and enhancing

engagement and learning outcomes. DLIs can enhance knowledge, understanding, and application learning, which makes it applicable to a variety of learning scenarios in education. This result confirmed that DLIs help teachers understand and use technology to support meaningful student learning.

Table 2: Teachers' technical knowledge skills

Elements of the technical knowledge skills	Rank	M	SD	Response
1. I have sufficient DLIs to use modern technologies easily	3	4.2	0.843	Agree
2. I have skills in how designing e-learning courses that develop students' knowledge and skills effectively	10	3.9	1.014	Agree
3. I have sufficient knowledge of the use of popular desktop publishing software	2	4.2	0.929	Agree
4. I have skills in using search engines and databases to find the required information	1	4.5	0.766	Strongly Agree
5. I know the use of artificial intelligence applications in education	14	3.3	1.301	Neutral
6. I can use appropriate DLIs to communicate educational content	5	4.1	0.946	Agree
7. I employ appropriate techniques to design the content of the courses I teach	9	4.0	1.011	Agree
8. I can evaluate the effectiveness of e-courses by the quality standards of DLIs	8	4.0	0.976	Agree
9. I can design DLIs activities that meet the needs of people with special needs	13	3.5	1.216	Agree
10. I use active learning strategies in technology-enhanced environments effectively	6	4.1	0.972	Agree
11. I can design interactive learning activities using appropriate DLIs	12	3.7	1.175	Agree
12. know how to design course learning discussions using appropriate web applications	11	3.8	1.118	Agree
13. I have skills in using some editing programs, image, and video processing	7	4.0	1.008	Agree
14. I have the skill of using DLIs to interact with students and parents	4	4.2	0.918	Agree
Total		4.0	0.796	Agree

6.3 Digital security skills of teachers

It is clear from Table (3) that item 17 obtained the highest average on this axis (agree), with an average of 4.4 of those who participated in the study. Item 18 received the lowest acceptance rate with an average of 3.65 of those who participated in the study. The results also show that the overall opinion of this axis is (agree) with an average of 3.47 of those who participated in the study.

The results of this study confirmed that privacy is the greatest concern for many learners these days, especially with the great technical development, the expansion of means of communication, and the increasing number of digital accounts that any individual can create. Therefore, this finding emphasised the need to implement strong practices to create secure passwords for their digital accounts and know the types of cybercrime and how to address and prevent them.

Table 3: Teachers' Digital Security Skills

Elements of the Digital Security Axis	Rank	M	SD	Response
1. I can download and install reliable software on computers	3	4.10	0.977	Agree
2. I know usage policy, intellectual property, and respect for privacy	2	4.19	0.943	Agree
3. I know how to create strong passwords for my digital accounts	1	4.40	0.856	Agree
4. I know about cybercrime, methods of treatment and prevention	10	3.65	1.194	Agree
5. I can install security updates	5	3.89	1.094	Agree
6. I know trusted educational sites	4	4.05	1.010	Agree
7. I can use firewalls, antivirus software	7	3.81	1.140	Agree
8. Master the backup of sensitive data, and store them securely	6	3.89	1.082	Agree
9. I can help students facing digital security problems during distance learning	8	3.77	1.137	Agree
10. I can train students in digital privacy skills	9	3.76	1.153	Agree
Total		3.95	0.892	Agree

6.4 Teachers' communication and collaboration skills

As shown in Table (4), item 29 received the highest average on this axis (agree), with an average of 4.19. Nineteen teachers participated in this area of the study. Thus, it is the best skill enjoyed by teachers on this axis. Item 28 gained the lowest average in this axis of 4.02, and the overall opinion is (agreed) from those who participated in the study. The results also show that the overall opinion of this axis is (agree) with an average of 4.02 of those who participated in the study. This result highlighted that DLIs effectively build student and teacher participation, interaction, collaboration,

and communication.

Table 4: Teachers' communication and collaboration skills

Elements of the axis of communication and cooperation	Rank	M	SD	Response
25. I have the skill of communicating with others via the Internet	2	4.15	0.969	I agree
26. I know the most important sources of information and learning of the content of the online courses I teach	4	4.08	0.953	I agree
27. I can develop knowledge to teach the content of my courses by joining virtual professional learning communities	3	4.15	0.971	I agree
28. I can help colleagues adopt modern educational strategies in DLIs environments	6	4.02	0.999	I agree
29. I can continue learning and participating in vocational training programs	1	4.19	0.934	I agree
30. I have the skill of learning advanced technology and following up on its innovations with ease	5	4.04	0.981	I agree
Total		4.10	0.846	I agree

6.5 Teachers' problem-solving skills

As can be seen in Table (5), the first item received the highest average on this axis (agree), with an average of 4.02 among those who participated in the study; thus, this is the best skill enjoyed by teachers on this axis. Item 37 gained the lowest average in this axis 3.89, and the overall opinion is (agree) from those who participated in the study. The results also show that the overall opinion of this axis is (agree), with an average of 3.95 of those who participated in the study. This result emphasised the need to support problem-solving methodologies in the DLIs environment for the discovery, treatment, or prevention of problem occurrence.

Table 5: Teachers' problem-solving skills

Elements of the problem-solving axis	Rank	M	SD	Response
31. I can detect and solve technical problems encountered during teaching	1	4.02	1.005	Agree
32. I can help students discover and solve the technical problems they face/	4	3.96	1.047	Agree
33. I can predict how the use of applications of advanced digital technologies will affect the educational process	3	3.97	1.040	Agree
34. I have the skill of effectively assessing student learning in learning environments enhanced by DLIs	5	3.95	1.023	Agree
35. I have skills in managing and enhancing interaction in the DLIs environment among students	2	4.00	1.015	Agree
36. I have proficiency in planning and adopting DLIs for educational purposes in the educational environment	6	3.93	1.031	Agree
37. I can support problem-solving methodologies in the DLIs environment of discovery, treatment, or prevention of the occurrence of the problem	8	3.89	1.009	Agree
38. I have the skill of adapting teaching methods to address learning difficulties faced by various categories of students in the DLIs environment	7	3.90	1.034	Agree
Total		3.95	0.918	Agree

6.6 Teachers' data analysis skills

As indicated in Table (6), the fifth axis (data analysis) received an average of 4.04 (agree) from those who participated in the study. Item 41 received the highest average of 4.12 by choosing (agree) from those who participated in the study. The results also show that item 43 obtained the lowest average of 3.88, (agree), from the study participants. This finding highlighted the value of using data analysis to improve educational practice and make more effective decisions about teaching, learning, and classroom management.

Table 6: Data Analysis Skills of Teachers

Elements of the data analysis axis	Rank	M	SD	Response
39. Choosing appropriate assessment tools to assess students' learning of different concepts	2	4.09	0.970	Agree
40. Employing d DLIs in evaluating students' learning of course content	3	4.08	1.005	Agree
41. I can use data to improve my educational practice	1	4.12	0.941	Agree
42. I know how to use data to help students learn effectively	4	4.05	0.960	Agree
43. I have enough necessary resources to use data effectively, such as software, technical support	6	3.88	1.073	Agree
44. I have the skill of using a variety of tools to collect and analyze data	5	4.04	0.998	Agree
Total		**4.04**	**0.878**	**Agree**

6.7 Second question answer

What digital skills do ISTs in the Al-Namas Governorate need to develop?

Regarding the axis of technical knowledge skills, the results of the study from Tables (2) and (9) showed that all teachers need to develop their skills in:

- designing innovative educational activities that meet the needs of people with special needs; and
- acquiring knowledge of the use of artificial intelligence applications in education.

The results also confirmed that the practitioner teacher category needs to develop their skills in the field of technical knowledge more than the novice teacher category.

Regarding the digital security skills axis, the results of the study from Tables (3) and (8) showed that all teachers need to develop their skills in:

- their knowledge of cybercrime, methods of treatment, and prevention.

The results also showed that teachers of sociology, Islamic studies, Arabic language, and mathematics need to develop digital security skills more than teachers of other subjects.

Regarding the axis of communication and collaboration skills, the results of the study from Tables (4) and (8) showed that all male and female teachers need to develop their skills in the field of:

- helping the professional community to adopt modern educational strategies in DLIs environments.

The results also showed that teachers of sociology, Islamic studies, Arabic language, and mathematics need to develop communication and cooperation skills more than teachers of other subjects.

Regarding the axis of problem-solving skills, the results of the study from Tables (5) and (8) showed that all male and female teachers need to develop their skills in the field of:

- supporting problem-solving methodologies in the e-learning environment of discovery, treatment, or prevention of the occurrence of the problem.

The results also showed that men need to develop their skills in problem-solving and data analysis more than women.

Regarding the data analysis skills axis, the results of the study from Table (6) show that all male and female teachers need to develop their skills to ensure that they:

- have the necessary resources to use data effectively such as software, and technical support.

6.8 Third question answer

To what extent is the idea of providing a training program that supports the DLIS of teachers?
According to the responses of the respondents, the results of this question were as follows:

Table 7: Providing a program that supports the DLIS teachers.

Elements of the data analysis axis.	M	SD	Response
To what degree do you support the idea of offering a training program on DLIS for teachers?	4.56	0.680	Strongly agree

The results of the above table confirmed that the number of strongly agreeing teachers to offer a training program on DLIS for teachers was 261 (65.3%), and the number of those who agreed was 105 (26.3%). The final decision was (strongly agree) with an average of 4.56 out of 5.

The issue of training is an important one to consider when studying the use of DLIS in education. This result confirmed that most of the teachers involved in this study had not received any training on the use of DLIS within an educational environment, whereas they would like to receive more support by being provided with quality training and continuing professional development programs. As a result, the existing literature illustrates that many tutors require additional support from their institutions in the form of training courses and assistance in achieving a purposeful

integration of these tools in academia. Alenezi (2023) found that academic institutions in KSA do provide training on the use of educational technologies in general. However, the actual difficulty was the teachers' time constraints, which made them unable to attend and participate in these training sessions due to the academic workload.

6.9 Fourth question answer

To answer the second question of the study, which states: Are there statistically significant differences at the level of significance (α≤0.05) between teachers' responses towards the degree of availability of DLIS in teaching due to variables (gender, specialization, professional rank, and attendance of training courses)?

First, the researcher used the one-way ANOVA test to study the impact of gender on teachers' responses to the degree of availability of DLIS, and the results were as follows:

Table 8: One-way ANOVA test based on gender variable.

Axis	Comparison position	SS	Df	M	F	Sig.
Technical knowledge	Between groups	0.327	1	0.327	0.516	0.473 ** P < 0.01.
	Within groups	252.326	398	0.634		
	Total	252.653	399			
Digital Security	Between groups	0.582	1	0.582	0.731	0.393 ** P < 0.01.
	Within groups	317.058	398	0.797		
	Total	317.64	399			
Communication and Collaboration	Between groups	2.756	1	2.756	3.878	0.05 ** P < 0.01.
	Within groups	282.841	398	0.711		
	Total	285.597	399			
Problem-solving	Between groups	3.481	1	3.481	4.161	0.042 * P < 0.05.
	Within groups	332.953	398	0.837		
	Total	336.434	399			
Data Analysis	Between groups	3.236	1	3.236	4.233	0.04 * P < 0.05.
	Within groups	304.291	398	0.765		
	Total	307.528	399			
All Axes	Between groups	1.36	1	1.36	2.094	0.149 ** P < 0.01.
	Within groups	258.592	398	0.65		
	Total	259.952	399			

** P < 0.01. * P < 0.05.

Table 8 indicates that there are statistically significant gender differences. Statistically, the differences were significantly higher for females in the axis of problem-solving and data analysis.
Our assessments conducted on the entire sample set revealed statistically significant distinctions between the different specializations in cooperation, communication, and digital security, favoring computer specialization.

Second, the researcher used the one-way ANOVA test to find out the impact of specialization on teachers' responses to the degree of availability of DLIS in teaching. The results are shown in the following table:

Table 9: One-way ANOVA test based on specialisation variable.

Axis	Comparison position	SS	df	M	F	Sig.
Technical knowledge	Between groups	5.812	7	0.83	1.319	0.24 ** P < 0.01.
	Within groups	246.84	392	0.63		
	Total	252.653	399			
Digital Security	Between groups	14.409	7	2.058	2.661	0.011

						* P < 0.05.
	Within groups	303.231	392	0.774		
	Total	317.64	399			
Communication &Collaboration	Between groups	10.042	7	1.435	2.041	0.049 * P < 0.05.
	Within groups	275.555	392	0.703		
	Total	285.597	399			
Problem-solving	Between groups	8.709	7	1.244	1.488	0.17 * P < 0.05.
	Within groups	327.725	392	0.836		
	Total	336.434	399			
Data Analysis	Between groups	7.723	7	1.103	1.442	0.187 ** P < 0.01.
	Within groups	299.805	392	0.765		
	Total	307.528	399			
All Axes	Between groups	8.169	7	1.167	1.817	0.083 ** P < 0.01.
	Within groups	251.783	392	0.642		
	Total	259.952	399			

** P < 0.01. * P < 0.05.

As shown in Table 9, there are statistically significant differences between the different disciplines in the field of digital security and the field of communication and cooperation. Statistically, the computer specialisation was significantly higher, as it outperformed mathematics, Islamic education, and social studies in the field of digital security, with statistically significant differences, and outperformed Islamic education, Arabic language, and social studies in the field of communication and cooperation with statistically significant differences.

Third, the researcher used the one-way ANOVA test to study the impact of (professional rank) on teachers' responses toward the degree of availability of DLIS in teaching, and the results were as follows:

Table 10: One-way ANOVA test based on professional rank variable.

Axis	Comparison position	SS	df	M	F	Sig
Technical knowledge	Between groups	6.013	4	1.503	2.408	0.049 * P < 0.05.
	Within groups	246.639	395	0.624		
	Total	252.653	399			
Digital Security	Between groups	4.586	4	1.147	1.447	0.218 ** P < 0.01.
	Within groups	313.054	395	0.793		
	Total	317.64	399			
Communication and Collaboration	Between groups	5.292	4	1.323	1.864	0.116 ** P < 0.01.
	Within groups	280.305	395	0.71		
	Total	285.597	399			
Problem-solving	Between groups	6.756	4	1.689	2.024	0.09 ** P < 0.01.
	Within groups	329.679	395	0.835		
	Total	336.434	399			
Data Analysis	Between groups	6.787	4	1.697	2.229	0.065 ** P < 0.01.
	Within groups	300.741	395	0.761		
	Total	307.528	399			
All Axes	Between groups	5.624	4	1.406	2.184	0.07 ** P < 0.01.
	Within groups	254.328	395	0.644		
	Total	259.952	399			

** P < 0.01. * P < 0.05.

The results shown in Table 10 revealed that there are statistically significant differences between the professional ranks, especially between the ranks of (teacher) and (practicing teacher). Statistically, the differences were significantly higher for the teacher in the field of (technical knowledge), as the teacher outperformed the practicing teacher in the field of (technical knowledge) with statistically

significant differences at the level of significance 0.05.

Fourth, the researcher used the one-way ANOVA test to find out the effect of (attending training courses) on teachers' responses toward the degree of availability of DLIS in teaching. The results were as follows:

Table 11: One-way ANOVA test based on attending training courses variable.

Axis	Comparison position	SS	Df	M	F	Sig
Technical knowledge	Between groups	20.762	1	20.762	35.635	.0000 * P < 0.05.
	Within groups	231.890	398	.583		
	Total	252.653	399			
Digital Security	Between groups	25.710	1	25.710	35.051	.0000 * P < 0.05.
	Within groups	291.930	398	.733		
	Total	317.640	399			
Communication and Collaboration	Between groups	16.597	1	16.597	24.556	.0000 * P < 0.05.
	Within groups	269.000	398	.676		
	Total	285.597	399			
Problem-solving	Between groups	25.794	1	25.794	33.048	.0000 * P < 0.05.
	Within groups	310.640	398	.781		
	Total	336.434	399			
Data Analysis	Between groups	18.445	1	18.445	25.394	.0000 * P < 0.05.
	Within groups	289.083	398	.726		
	Total	307.528	399			
All Axes	Between groups	21.779	1	21.779	36.394	.0000 * P < 0.05.
	Within groups	238.173	398	.598		
	Total	259.952	399			

** P < 0.01. * P < 0.05.

As shown in Table 11, there are statistically significant differences between (those who enrolled in training courses in the field of developing DLIS) and (those who did not enroll). Statistically, the teachers who enrolled in training courses outperformed teachers who did not enroll with statistically significant differences at the level of significance 0.01; and less, and this underscores the importance of training in these areas.

7. Conclusion

This study was conducted in a small rural governorate located in the southwest of KSA to determine DLIS in a sample of Saudi ISTs randomly chosen to represent the teacher population. The SPSS Version 21 (Statistical Package for Social Sciences) software was used to analyse the dataset collected from the questionnaires.

The study sample was limited only to teachers. It would be useful to conduct further studies involving students. A descriptive approach method (questionnaire) was used to achieve the goals of this study. It would be useful to conduct further studies involving additional tools, such as interviews or observations, to enhance the credibility of the data gathered.

Through the study findings, we have determined the need to provide specialised training on DLIS to teachers, especially in artificial intelligence applications in education, and to design innovative educational activities that meet the needs of people with special needs and cybercrime, including methods of treatment and prevention. Additionally, there is a need to provide the resources necessary to use DLIS. The resources required include hardware, equipment, and software.

The study's limitations can be summarized in these simple points: 1) Performing extra-accurate calculations requires a massive sample dataset; in this respect, the limited number of teachers set up in Alnamas limits authors to gathering tera-Byte datasets. On the other hand, collecting a dataset

that includes all the Saudi teachers is quite acceptable; however, it is practically a very tough process and extremely expensive. Gathering the dataset was very exhausting due to factors such as a lack of interest from some teachers in filling out the study questionnaire.

Furthermore, the study also shows that more educational support for digital literacy is urgently needed, especially for more experienced tutors. Consequently, the Education Department in Al-Namas Governorate should develop plans to prepare teachers for the use of DLIs in the education environment by providing access to training programmes, workshops and conferences, and providing them with quality training and continuing professional development programmes.

Introducing DLIs into school settings in a formal manner would give rise to a fundamental change in teaching methods and learning styles at the Education Department in Al-Namas Governorate. As this study shows, using DLIs would support collaborative learning, allow students and tutors to generate and improve content, enhance teachers' communication skills and self-learning, and encourage critical and reflective thinking. A greater awareness of such benefits would encourage tutors to use DLIs.

Future research can be expanded to compare the same teacher sample after the teachers received a training module on DLIS. There is a need to conduct more extensive studies on the impact and benefits of artificial intelligence and cybersecurity applications so that teachers can optimally use digital innovation applications in education.

8. Acknowledgment

The authors extend their appreciation to the Deanship of Graduate Studies and Scientific Research at University of Bisha, Saudi Arabia for funding this research work through the Promising Program under Grant Number (UB- Promising -27 - 1445).

References

Abdul Rahim, W. (2019). "Digital Education: Concept, Components, and Applications." *Journal of Educational Studies*, 2(1), 1-22.

Albahiri, M. H., & Alhaj, A. A. M. (2023). Teachers in the Twenty-first Century and Challenges of Technological Innovation in Teaching and Learning. *Journal of Positive Psychology and Wellbeing*, 836-852.

Alenezi, M. (2023). Digital learning and digital institution in higher education. *Education Sciences*, 13(1), 88.

Alexandro, R., & Basrowi, B. (2024). Measuring the effectiveness of smart digital organizations on digital technology adoption: An empirical study of educational organizations in Indonesia. *International Journal of Data and Network Science*, 8(1), 139-150.

Al-Shamrani, A. (2019). "The Impact of Employing Digital learning tools on the Educational Process and improving its outcomes".*Arab Journal of Educational and Psychological Sciences*, 8(3), 145-170

Al-Shebel, Y. (2021) reality of digital learning in enhancing 21st-century skills from the point of view of mathematics teachers and supervisors in Saudi Arabia. *Shaqra University Journal of Humanities and Administrative Sciences*, No. 15, pp. 341-366.

Budnyk, O., Matveieva, N., Fomin, K., Nazarenko, T., &Kalabska, V. (2021). Preparation of future teachers for the introduction of digital innovation in a rural school: problems and prospects. *Revista Brasileira De Educação Do Campo*, *6*, e13124-e13124.

Ciarli, T., Kenney, M., Massini, S., & Piscitello, L. (2021). Digital technologies, innovation, and skills: Emerging trajectories and challenges. *Research Policy*, 50(7), 104289.

Clark, E. (2022). Engaging Students: Effective Digital Interaction Strategies. Pearson.

Davis, S. (2022). Artificial Intelligence in Education: Enhancing Learning Experiences. *Oxford University Press*.

Habal, M. B. (2024). Basic Research is an Integral Part of the Education Process for Sophistication, Enhancement, Advances, Innovation, Leadership, and a Better Patient Outcome in the Brave New Digital World. *Journal of Craniofacial Surgery*, 35(1), 1-2.

Joosten, T., Lee-McCarthy, K., Harness, L., & Paulus, R. (2020). Digital Learning Innovation Trends. *Online Learning Consortium*.

Kryukov, V., & Gorin, A. (2017). Digital technologies as education innovation at universities. *Australian Educat ional Computing*, *32*(1), 1-16.

Kumari, P., & Naaz, I. (2020). Digital learning through MOOCs: Advantages, Outcomes & Challenges. *Sambodhi, UGC CARE Journal*, *43*(4), 18-22.

Majrashi, K. (2023). Developing a model of the three distractions process for digital innovation.*Public Affairs*, vol. 64, vol. 1, 217 - 264. Retrieved from:http://search.mandumah.com/Record/1398054

Motorga, M. E. (2023). Digital transformation in adult education: empowering global understanding and sustainable development. Revista de Științe ale Educației, 48(2), 46-63.*Journal of Management Education*, 47(2), 166-203.

Shwedeh, F. (2024). Harnessing digital issue in adopting metaverse technology in higher education institutions: Evidence from the United Arab Emirates. *International Journal of Data and Network Science*, 8(1), 489-504.

Singh, H. P., Alshammari, K., & Singh, H. P. (2021). Impacts of Digital technology-enabled personalized and adaptive learning on student learning performance: A TOE framework for Saudi Arabia. *& Applied Sciences & Technologies*, *12*(13), 1-12.

Taha, M. (2023). "For the teaching competencies necessary for science teachers in promoting digital innovation to solve environmental problems and obstacles".*Mansoura University*. Issue 122 April.

Turner, K. (2020). Digital Content Delivery: Best Practices for Educators. Routledge.

Wang, P., Meng, X., & Butler, B. (2015). How Do Community Ecology and Structure Shape Digital Innovation Strategy?

White, L. (2021). Mastering Digital Editing and Multimedia Production. Elsevier.

Zain, S. (2021). Digital transformation trends in education. In *Future directions in digital information* (pp. 223-234). Chandos Publishing.