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Challenges and Opportunities in Integrating ICT into Teaching and Learning: A Study of Higher Educational Institutions in Iraqi Kurdistan

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Abstrak

Integrasi TIK telah mengubah metode pengajaran konvensional di perguruan tinggi; namun, hambatan seperti kesenjangan digital menghambat penggunaannya. Penelitian ini menggunakan metode survei untuk mengkaji tantangan pengintegrasian TIK dalam pengajaran dan pembelajaran di lembaga pendidikan tinggi di Wilayah Kurdistan, Irak. Guru-guru dari berbagai perguruan tinggi di Kurdistan berpartisipasi dalam survei yang terbagi menjadi tiga segmen: dampak TIK pada mahasiswa, kesulitan penggunaan alat TIK dalam pengajaran, dan pengalaman positif pendidik dalam menggunakan TIK. Penelitian ini menggunakan modul pembelajaran mesin untuk mengidentifikasi hubungan antara tantangan dan alat TIK. Hasil penelitian menunjukkan bahwa penggunaan alat TIK memiliki dampak positif pada mahasiswa, tetapi tantangan seperti kurangnya fasilitas dan pelatihan menghambat penggunaannya. Pada akhirnya, penelitian ini menyimpulkan bahwa integrasi TIK dalam pengajaran dan pembelajaran di lembaga pendidikan tinggi di Kurdistan Irak sangat penting, dan menekankan perlunya pelatihan dan sumber daya tambahan untuk mendukung proses tersebut.

Abstract

The integration of ICT has transformed conventional teaching methods in universities; however, obstacles such as the digital divide hinder its usage. This study employs a survey method to examine the challenges of incorporating ICT into teaching and learning in higher educational institutions in the Kurdistan Region of Iraq. Teachers from various universities across Kurdistan participated in a survey divided into three segments: the impact of ICT on students, difficulties in using ICT tools in teaching, and positive experiences of educators using ICT. The study utilizes machine learning modules to identify relationships between the challenges and ICT tools. The results demonstrate that the use of ICT tools has a positive impact on students, but challenges such as a lack of facilities and training hinder their use. Ultimately, the study concludes that integrating ICT into teaching and learning in higher educational institutions in Iraqi Kurdistan is vital, and emphasizes the need for additional training and resources to support the process.

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INTRODUCTION

The rapid development of Information and Communication Technology (ICT) has revolutionized the educational system, making it an essential part of teaching and learning in universities around the world. ICT has become the backbone of the educational and teaching system, providing access to technological tools and resources for managing, creating, collecting, distributing, and communicating information (Komala et al., 2020). The higher education system has greatly benefited from this significant change, enhancing the quality of education. ICT transcends the boundaries of colleges, offering students the opportunity to learn regardless of time and place. They can gather data whenever and wherever they want. In professional practice, this change enables teachers to incorporate more complex real-world projects by utilizing ICT tools and resources, thereby improving educational approaches (Bhat et al., 2018).

However, the adoption of ICT tools in universities is not without its challenges and barriers. These challenges include issues related to the digital divide, effective training and support, cost, adapting traditional teaching methods, ease of access for students with disabilities, and the need to keep up with rapid technological changes (Nyakito et al., 2021).

The COVID-19 pandemic has further accelerated the adoption of digital learning materials in universities around the world (Mishra et al., 2020). The sudden shift from traditional learning to e-learning due to the pandemic has brought unprecedented changes to the higher education sector, with universities having to create their own platforms or integrate existing ones to continue teaching (Adedoyin & Soykan, 2020). However, the implementation of e-learning in underdeveloped countries has proven to be a challenge due to inadequate digital infrastructures (Anwar & Adnan, 2020).

Although the use of ICT in education has garnered significant attention from researchers and policymakers in the Arab world, there are still various barriers to its effective implementation, including the need for teacher training, infrastructure improvement, digital content development, and cultural norms. Cultural norms and traditional teaching methods can limit the utilization of technology in education, necessitating the addressing of these factors to successfully implement ICT tools. Despite the challenges, this study emphasizes the potential benefits of ICT in education, such as improved student engagement and increased access to learning resources. Hence, it is crucial to address challenges like teacher training and digital content development while considering the cultural factors for effective ICT integration in education (Al-Zahrani, 2015). Furthermore, the COVID-19 pandemic has introduced new challenges and barriers, such as inadequate teacher knowledge, limited learning facilities, and training courses for teachers and students (Quang & Ha, 2021).

Similar challenges have been observed in the Kurdistan Region of Iraq (KRI). Although some studies have identified barriers to ICT integration in these regions, few have specifically examined the challenges in the KRI, where ICTs have been extensively employed in the education system (Kareem, 2017).

This paper aims to contribute to the existing knowledge on the challenges and opportunities associated with ICT integration in higher education in the KRI. Through a survey of higher education teachers and data analysis using Python and machine learning techniques, the paper seeks to identify the challenges hindering the effective integration of ICTs and provide recommendations for addressing them. The study intends to shed light on the potential of ICTs in the Kurdistan education system and contribute to the enhancement of education standards in the region.

Previous research has identified several challenges to ICT integration in education, including resource and training limitations, teachers' resistance to change, and stringent government policies. For instance, a qualitative case study conducted in four secondary schools in Saudi Arabia found that the lack of resources and training, teachers' resistance to change, and strict government policies were significant barriers to ICT integration (Al-Zahrani, 2015). Similarly, a study focused on the challenges of using ICT tools in higher education in Iraq identified various obstacles, such as inadequate infrastructure, the need for faculty training and support, and the necessity of effective policies and strategies for ICT implementation. However, despite these challenges, the Kurdistan Region of Iraq has witnessed extensive utilization of ICTs in the education system, with teachers and learners employing a wide range of ICTs to enhance their English language skills (Kareem, 2017). This paper seeks to build upon previous research and contribute to the understanding of the challenges and opportunities associated with ICT integ-

ration in higher education in the KRI.

LITERATURE REVIEW

Personal development of teachers is another important aspect of using ICT tools. In universities, ICT is recognized as a source of motivation (Avidov-Ungar & Amir, 2018). While most university lecturers appreciate the use of ICT, it is suggested that correct outcomes and training are necessary. The use of ICT in classes has been investigated (Imon, 2017). Integrating ICT into the teaching process, especially through the internet, enables efficient teaching and facilitates innovative approaches (Neziha, 2019). The development of advanced ICT devices makes the motivational role of teachers vital in higher education settings. The attitude of teachers towards utilizing computers in classrooms is generally positive, as they consider computers to be excellent tools for teaching (Rafeeq & Ali, 2021). However, for effective technology use in the classroom, teachers need to be taught how to advance educational innovation, ICT appliance innovation, and activity innovation in their instruction. A positive relationship between these developments has been observed (Chou et al., 2018). Teachers use multimedia in lectures to make them more interesting, and applications like Excel are used for arithmetic work, while Microsoft Word is employed for various activities (Siddiquah & Salim, 2017).

Computers and the internet have been extensively utilized by instructors in various classroom activities, and email is commonly employed by higher-level teachers as an ICT tool for communication (Padmavathi, 2013). Advanced ICT represents a revolution in the teaching process, creating a more effective and enhanced learning environment. Teachers become more productive, and classrooms become more engaging through the use of technology. The traditional classroom undergoes a complete transformation into a technology-based classroom, fostering collaboration among all students (Saqib Khan et al., 2015). The use of modern ICT devices and applications in education brings significant benefits. By leveraging ICT tools, instructors can enhance students' knowledge and skills, resulting in increased motivation and improved teaching quality (Olofsson et al., 2018).

Modern ICT applications have a significant impact on the teaching and learning process in private universities. Innovative tools are utilized for training the teaching staff, leading to more innovative, evaluative, and valuable student learning experiences. The university administration faculty shows enthusiasm in applying ICT tools and equipping computer laboratories (Khokhar & Javiad, 2016). One of the latest generations of advanced media platforms is social webs, which allow for content development and sharing. Instructors utilize platforms like YouTube to create and share lectures with their students (Dabbagh et al., 2019).

However, there are challenges faced by teachers and professors when integrating ICT into classroom activities. According to a study, two main factors that hinder teachers' interest in using ICT tools are time constraints and inadequate computer applications in labs (Azmi, 2017; Miima et al., 2013). Insufficient availability of related courses and a lack of technology experts among teachers (Lubis et al., 2018) also contribute to teachers' lack of confidence in the ICT field (Nikolopoulou & Gialamas, 2016). Nonetheless, research highlights the importance of integrating technology in pedagogical courses and practices, suggesting that not only do students benefit from enhanced facilities, but teachers also gain advantages in the learning process. The use of technology in pedagogy makes teachers more competent in teaching, ultimately facilitating more efficient student learning in various content areas (Akram et al., 2021; Chen et al., 2019; Wakil et al., 2018).

The challenges of integrating ICT in teaching are numerous. Firstly, many universities and institutions lack computers or use outdated ones, resulting in slow performance and a loss of interest among students. Maintenance is often overlooked, leading to malfunctioning. Secondly, teachers require extensive training to become efficient in using ICT, and many are resistant to change, preferring traditional teaching methods. Fear of technical difficulties and the perception of a mechanized teaching process hinder the adoption of ICT. Thirdly, financial support and the recruitment of ICT experts are necessary but can be slow, making the implementation of ICT a lengthy process. An updated curriculum and technical support are crucial for successful ICT integration (Komala et al., 2020).

Some studies focus on the benefits of using technology for teachers. For example, one study found that teachers who are proficient in using technology prefer to spend more time on teaching. Moreover, teachers' competencies in

technology enable them to adapt to various teaching approaches and strategies, thereby enhancing their performance (Vongkulluksn et al., 2018). It is also suggested that pedagogical practices encompass two different main concepts. In summary, using technology effectively in the teaching process is feasible if instructors are well-equipped with the fundamental capacities required (Ifinedo et al., 2019).

Prior research has demonstrated that incorporating ICT tools in education can improve the teaching and learning process. However, certain obstacles such as insufficient resources and inadequate training for educators hinder progress. Experts also suggest that the integration of technology in classrooms can lead to more proficient teachers, innovative teaching methods, and highly skilled students. By providing proper guidance and training, teachers can enhance their proficiency in utilizing ICT and adapt to new teaching strategies and approaches.

METHOD

In this paper, data obtained from all the respondents were collected and analyzed using a quantitative methodology. The questionnaire included sections specifically designed to address research objectives regarding the effects of integrating ICT for students in the learning process at universities in KRI. Therefore, the questionnaire was distributed to gather data from all the respondents. A sample of 104 teachers and university staff was selected from the universities in KRI.

The majority of the participants (60.6%) were male, while females accounted for 39.4%. Regarding educational backgrounds, most of the participants (53.8%) held master's degrees (MSc/MA), followed by bachelor's degrees (BA/BSc) (17.3%), PhD (25%), and other educational backgrounds (3.8%). The age range of the participants was as follows: under 25 years old (14.4%), 26-35 years old (34.6%), 36-45 years old (36.5%), and above 45 years old (14.4%), as shown in Table 1.

Table 1 Demographic finding on sample

Factors.	Frequency	Percentage
Gender		
Male	63	60.6%
Female	41	39.4%
Educational Background		
Bachelors Degree	18	17.3%
Master's Degree	56	53.8%
PhD	26	25%
Others	4	3.8%
Age		
Under 25	15	14.4%
26-35	36	34.6%
36-45	38	36.5%
45+	15	14.4%

A. Process Control (Mechanism)

The main instrument used in this study was a survey questionnaire consisting of twenty items to analyze the effectiveness of ICT integration in the learning and teaching processes at universities in the KRI. The questionnaire comprised four sections. The first section focused on factors such as gender, age, and educational background. The second section explored teachers' perceptions of ICT tool implementation in learning and teaching. The answers were rated on a 5-point Likert scale, ranging from "Strongly Agree=5" to "Strongly Disagree=1". The third and fourth sections utilized a different 5-point Likert scale, where the options were "Always=5, Often=4, Sometimes=3, Rarely=2, Never=1". The third section addressed the challenges and obstacles faced by teachers in using ICT. The final section examined how teachers leveraged technology and utilized ICT tools in the teaching process.

B. Data analysis technique

In this paper, the data analysis was conducted using Python and various imported libraries required for data analysis, such as Pandas, Matplotlib, and NumPy. The analysis included both inferential and descriptive analyses. The descriptive analysis was utilized by the researcher to examine the percentage and frequency of the population. It involved determining standard deviation, mean, frequency, and percentage to assess the effectiveness of integrating ICT in teaching and learning processes in universities in Kurdistan-Iraq. Additionally, the challenges affecting the higher education sector were analyzed. Through the regression module in machine learning, hypotheses were formulated to explore the impact of these challenges on the use of ICT in a positive manner.

RESULT AND DISCUSSION

The questions were categorized into three sections. The first section included questions related to utilizing ICT to enhance the level of education. The second section addressed the obstacles faced when using ICT tools in the teaching process. The third section focused on highlighting teachers' positive experiences in using ICT in their classes and the benefits derived from ICT implementation to enhance the teaching and learning processes. Detailed explanations of the results from each section are provided below.

A. Effects of ICT on Students

Teachers' perception of ICT use reveals the benefits of incorporating ICT in teaching and learning, as evident from the provided data in Table 2. Many teachers have observed that using ICT aids in improving the teaching process and enables them to stay updated when explaining new materials to students. For instance, teachers utilize ICT tools such as Google Classroom to establish academic relationships with students. Through this platform, teachers can share lessons, assignments, and conduct quizzes, thereby extending the learning experience beyond the traditional classroom setting. Additionally, students access a significant amount of information for their lessons through apps like YouTube. The lowest mean, which is 3.88, is associated with the last question regarding ICT facilities for students. This can be attributed to the inadequate availability of ICT tools such as computers and internet access.

Table 2 clarifies that teachers have a positive perception of ICT use in teaching. They believe that it helps students concentrate more, understand concepts more easily, feel more autonomous in their learning, facilitates collaborative work among students, and encourages them to put in more effort into what they are learning.

Figure 1 displays the total mean and standard deviation from Table 2, with a mean of 4.30 and a standard deviation of 0.99. This result indicates the positive outlook of teachers towards using ICT, which has a significant impact on students' improvement.

B. The Using of ICT in Higher Education (HE)

Table 3 provides valuable insights into teachers' utilization of ICT tools in teaching and their effectiveness in enhancing students' learning experiences. For example, for the item "use emails to communicate with others" (M=4.12, SD=1.04), the mean and standard deviation indicate a high level of usage and effectiveness. In contrast, for statements such as "creating and maintaining blogs or websites" (M=2.82, SD=1.39), "discussion forum on the internet" (M=2.48, SD=1.28), "edit a questionnaire online" (M=2.52, SD=1.20), and "participate in social networks" (M=2.99, SD=0.91), the means and standard deviations are lower.

Comparing these experiences with others shown in Table 3, it is evident that instructors make greater use of emails. The highest mean in Table 3 is 4.12, indicating that emails are particularly effective in facilitating communication with students. This can be attributed to the speed, convenience, and accessibility of emails, as they are fast, paperless, and accessible from anywhere.

Figure 2 reveals the experiences of teachers in using ICT in classrooms, with a mean of 2.98 and a standard deviation of 1.40. The results indicate the utilization of emails and websites by teachers and students for easier communication and the updating of materials. However, the table also highlights the insufficient experience of teachers in using ICT.

C. Challenges in Using ICT Tools in Teaching & Learning

In this section, the questions focused on the barriers that teachers face when using ICT in teaching. These challenges are presented in Table 4.

According to the teachers' perceptions, the three main obstacles related to the use of ICT tools were as follows: the insufficiency of internet-connected computers (M=3.9, SD=0.89), insufficient bandwidth or speed (M=3.62, SD=0.72), and outdated or malfunctioning college/institute computers (M=3.40, SD=0.77).

In addition to these three primary barriers, another significant obstacle identified was the lack of skills among teachers, as they often did not make an effort to improve their knowledge in using ICT. This is reflected in two statements: "lack of adequate skills in teachers" (M=3.01, SD=0.79) and "most teachers are not in favor of using ICT in the universities" (M=2.75, SD=0.98).

Figure 3 illustrates the numerous obstacles that hinder the easy implementation of ICT

Table 2 Effects of ICT on students

	Item	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	Mean	SD
1.	Students concentrate more on their learning	76	18	7	1	2	4.59	0.82
		73.1%	17.3%	6.7%	1%	1.9%		
2.	Students try harder in what they are learning	67	22	8	5	2	4.41	0.96
		64.4%	21.2%	7.7%	4.8%	1.9%		
3.	Students feel more autonomous in their learning (they can repeat exercises if needed, explore in more detail topics that they are interested in , etc..)	50	29	19	3	3	4.15	1.1
		48.1%	27.9%	18.3%	2.9%	2.9%		
4.	Students understand more easily what they learn	44	34	14	7	4	4.04	1.08
		42.7%	33%	13.8%	6.8%	3.9%		
5.	ICT facilitates collaborative work between students	35	42	11	11	5	3.88	1.13
		33.7%	40.4%	10.6%	10.6%	4.8%		

Table 3 Use of ICT Tools

	Item	Always	Often	Sometime	Rarely	Never	Mean	SD
1.	Use emails to communicate with other	51	24	21	6	2	4.12	1.04
		49%	23.1%	20.2%	5.8%	1.9%		
2.	Create and maintain blogs or web sites	14	25	19	20	26	2.82	1.39
		13.5%	24%	18.3%	19.2%	25%		
3.	Discussion forum on the internet	9	12	32	18	33	2.48	1.28
		8.7%	11.5%	30.8%	17.3%	31.7%		
4.	Edit a questionnaire online	9	10	32	28	25	2.52	1.20
		8.7%	9.6%	30.8%	26.9%	24%		
5.	Participate in social network	56	22	24	2	0	2.99	0.91
		53.8%	21.2%	23.1%	1.9%	0		

Figure 1 Teachers' Perceptions on Implementing ICT Tools in Teaching and Learning

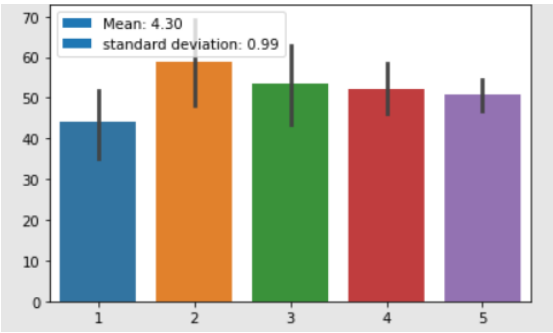
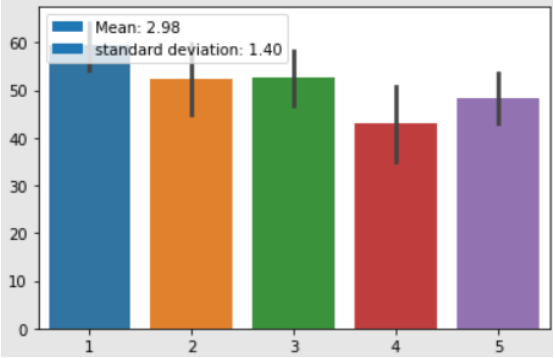


Figure 2 Use of ICT tools in classroom



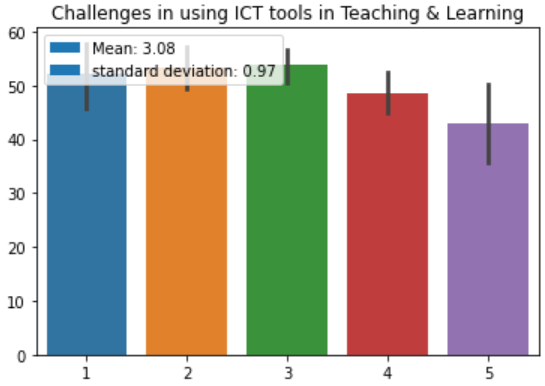
in the teaching process. The results, shown in this figure (M=3.08, SD=0.97), highlight various challenges faced by teachers and universities. Some of these obstacles are associated with the teachers themselves, while others are related to the universities.

In the following section, we explain how machine learning utilizes regression modules to analyze the impact of these challenges on the use of ICT. According to the questionnaire results, section 1 of the study indicates that instructors believe in the positive impact of ICT on student preparation and understanding, with a mean of 4.30 and a standard deviation of 0.99. This implies that 86% of questionnaire respondents agree that using ICT has a beneficial effect on learning.

Table 4 Challenges in using ICT tools in teaching and learning

	Item	Always	Often	Sometime	Rarely	Never	Mean	SD
1.	Insufficient number of internets connected computer	27	48	23	4	2	3.90	0.89
		26%	46.2%	22.1%	3.8%	1.9%		
2.	Insufficient bandwidth or speed	10	49	40	5	0	3.62	0.72
		9.6%	47.1%	38.5%	4.8%	0		
3.	College/institute computers out of data and/or needing repair	7	38	50	8	1	3.40	0.77
		6.7%	36.5%	48.1%	7.7%	1%		
4.	Lack of adequate skills of teachers	1	25	57	16	5	3.01	0.79
		1%	24%	54.8%	15.4%	4.8%		
5.	Insufficient technical support for teachers	3	27	47	20	7	2.99	0.91
		2.9%	26%	45.2%	19.2%	6.7%		
6.	Too difficult to integrate in ICT use into curriculum	3	17	37	40	5	2.76	0.90
		2.9%	16.7%	36.3%	39.2%	4.9%		
7.	Lack of pedagogical models on how to use ICT for learning	3	15	38	37	10	2.65	0.94
		2.9%	14.6%	36.9%	39.2%	10.7%		
8.	Most teachers not in favor of using ICT in university	2	23	37	31	11	2.75	0.98
		1.9%	22.1%	35.6%	29.8%	10.6%		
9.	Using ICT in teaching and learning not being a goal in our university	1	15	45	34	9	2.66	0.86
		1%	14.4%	43.3%	43.3%	8.7%		
10.	Lack of interest in teachers	3	20	46	27	8	2.84	0.92
		2.9%	19.2%	44.2%	26%	7.7%		

Figure 3 Challenges in using ICT Tools in Teaching and Learning



In section 2 (M=2.98, SD=1.40), 58% of respondents agree that ICT devices and tools have a positive influence on teaching, although they are not fully utilized for further improvement. The negligence of ICT tools in teaching is primarily due to the challenges that weaken their effectiveness in universities. Section 3 focuses on the challenges related to ICT use in the teaching and learning process (M=3.08, SD=0.97). 61% of participants believe that inadequate use of ICT is attributed to the challenges listed in Table 3, which negatively impact the utilization of ICT tools.

Hypothesis testing is employed to estimate the impact of these challenges on ICT use. Machine learning, one of the rapidly advancing fields in computer science, enables the learning of computer algorithms without direct programming. To investigate the significance of differences in challenges faced in ICT integration, the multiple linear regression model is utilized. This model analyzes the functional relationship between two variables, with one variable representing the dependent variable and the other representing the independent variable.

Multiple linear regression, estimated by ordinary least squares (OLS), is employed to predict the positive effects of challenges on ICT use. The study adopts the Likert scale, with a range from 5 (always) to 1 (never). The multiple linear regression model calculates the data based on the following formula: (1)

$$Y = \beta_0 + \beta_{1x_1} + \beta_{2x_2} + \ldots \beta_{px_p} + \varepsilon$$

Here, Y represents the predictor, X represents the independent value, B represents the coefficient used to multiply variables, and e represents the error term indicating the statistical

Table 5 The Relation between challenges & ICT Effect

	x	Coeff	Std err	t	p
1.	Insufficient number of internets connected computers	-0.0292	0.009	-3.245	0.002
2.	Insufficient bandwidth or speed	0.2889	0.103	-2.809	0.006
3.	College/institute computers are out of data and/or need repair	0.1813	0.106	-1.708	0.09
4.	Lack of adequate skills of teachers	-0.02172	0.008	-3.224	0.002
5.	Insufficient technical support for teachers	0.3185	0.99	-3.208	0.002
6.	Too difficult to integrate in ICT use into curriculum	0.0143	0.005	2.918	0.004
7.	Lack of pedagogical models on how to use ICT for learning	-0.234	0.008	-2.902	0.005
8.	Most teachers are not in favour of using ICT in the University	0.0140	0.006	2.473	0.015
9.	Using ICT in teaching and learning not being a goal of our university	0.3419	0.120	2.852	0.005
10.	Lack of interest in teachers	0.1126	0.026	4.349	0.000

deviation of data from reality.

Hypothesis testing is employed in section C of the survey, which addresses the challenges faced in ICT. X represents the independent value corresponding to the questions about challenges that teachers responded to. The standard error (Std err) measures the average deviation of the regression model error, with smaller values indicating better data. The "t" value represents the relationship between challenges (independent value) and the predictor, while the P value calculates the likelihood of observing a particular set if the null hypothesis is true.

If the P value is smaller than 0.05, it indicates a strong relationship between the challenges and ICT use, suggesting that challenges impact the use of ICT. Conversely, if the P value is greater than 0.05, it suggests that challenges have no significant impact on ICT use, as shown in Table 5. For some challenges, such as "Insufficient bandwidth or speed," the P value is 0.006, indicating a weak relationship between this challenge and ICT. However, for challenges with P values smaller than 0.05, such as "Lack of interest in teachers" (P value = 0.000), a strong and significant impact on ICT use is predicted. This indicates a direct effect on ICT utilization, with lesser use of ICT tools primarily attributed to the lack of interest among teachers.

CONCLUSION

This study aimed to examine the use of ICT in teaching and learning at higher education institutions in the Kurdistan Region of Iraq (KRI). Data was collected through a survey consisting of three sections: impact of ICT on students, barriers to ICT implementation, and positive teacher experiences. Results showed a positive impact of ICT on students, with major obstacles being the lack of infrastructure and training. Regression analysis highlighted "lack of interest from teachers" as the most significant barrier, followed by limited resources and technical support. Additional training and resources are necessary for successful ICT integration. Instructors should lead training efforts, considering workload and leisure time. Strong collaboration with private, national, and international organizations is essential for providing technology and support.

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