

# EXAMINING USER PERCEPTIONS AND CHALLENGES IN THE ADOPTION OF ICT-BASED LIBRARY SERVICES WITHIN SAUDI ARABIAN UNIVERSITIES

ANALISANDO AS PERCEPÇÕES E OS DESAFIOS DOS USUÁRIOS NA ADOÇÃO DE SERVIÇOS DE BIBLIOTECA BASEADOS EM TIC EM UNIVERSIDADES DA ARÁBIA SAUDITA

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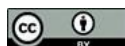
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## Abstract

This study explores the effectiveness of Information and Communication Technologies (ICTs) usage within university libraries in Saudi Arabia, underscoring the students' perception and satisfaction, alongside technological awareness in ICT-based library services. The research employed a mixed-method research design, gathering students' perspectives on Saudi Arabian University's ICT-based library resources. The findings indicate restricted awareness and ICT utilization, with a weaker association between student perception and satisfaction regarding using ICT-based library services. The results further comprehend barriers to ICT utilization, including outdated infrastructure and inadequacies in training programs and technology campaigns. The study highlights the essential need to enhance ICT

## Resumo

*Este estudo explora a eficácia do uso das Tecnologias da Informação e Comunicação (TICs) em bibliotecas universitárias na Arábia Saudita, destacando a percepção e a satisfação dos alunos, juntamente com a conscientização tecnológica em serviços bibliotecários baseados em TIC. A pesquisa utilizou um delineamento de pesquisa de método misto, reunindo as perspectivas dos alunos sobre os recursos bibliotecários baseados em TIC da Universidade da Arábia Saudita. Os resultados indicam conhecimento e utilização restritos das TICs, com uma associação mais fraca entre a percepção e a satisfação dos alunos em relação ao uso de serviços bibliotecários baseados em TICs. Os resultados abrangem ainda as barreiras à utilização das TICs, incluindo infraestrutura desatualizada e inadequações em*



infrastructure, alongside promoting digital literacy and fostering user engagement with ICT-based resources. The research recommends and addresses challenges in order to improve the effectiveness of ICT-based library services, contributing to the use of ICT in academic libraries, which aims to offer a foundation for future studies to improve library services that align well with evolving technological advancements.<sup>4</sup>

**Keywords:** Information and Communication Technology (ICT). User Perception. Library Services. Saudia Arab. Universities.

*programas de treinamento e campanhas tecnológicas. O estudo destaca a necessidade essencial de aprimorar a infraestrutura de TICs, promovendo a alfabetização digital e o engajamento do usuário com recursos baseados em TICs. A pesquisa recomenda e aborda os desafios para melhorar a eficácia dos serviços bibliotecários baseados em TICs, contribuindo para o uso das TICs em bibliotecas acadêmicas, que visa oferecer uma base para estudos futuros que aprimorem os serviços bibliotecários alinhados aos avanços tecnológicos em evolução.<sup>4</sup>*

**Palavras-chave:** Tecnologia da Informação e Comunicação (TIC). Percepção do Usuário. Serviços Bibliotecários. Arábia Saudita. Universidades.

## 1 INTRODUCTION

Possessing expertise in Information Technology has emerged as a prime skill in the 21st century. According to Hussain et al. (2013), ICT has exerted a profound influence on the traditional dynamics of libraries, leaving no option but to adopt newer technologies and developmental strategies to provide an exclusive educational platform to higher education students [1]. In today's rapidly evolving academic landscape, integrating Information and Communication Technologies (ICT) into university libraries has become a cornerstone for enhancing educational access [2]. With the increasing reliance on digital tools and online services, university libraries are expected to deliver more extensive services than books, journals, or magazines.

The digital influence on libraries has rendered the accession of resources alongside students' engagement toward higher learning and resource acquisition [3, 4]. According to Alfrih et al. (2011), the Kingdom of Saudi Arabia is among the most developed countries, aiming to adopt newer technologies to facilitate students [5]. Similarly, Saudi Arabia's higher education system shows a profound interest in integrating ICT-based learning and library services within its universities to become equivalent to the most well-known global institutions. Public and private universities in Saudi Arabia have begun implementing ICT-based library services [6].

However, despite technological advancements, a significant gap remains in understanding and navigating these technologies, especially among students. Moreover,

most universities highly augment the usage of digital tools. However, limited research has been conducted to assess the perception of students toward the utilization of online library services [7]. Therefore, the research investigates Saudi Arabian University students' perception of ICT awareness and the usage of ICT-based technology within libraries. Furthermore, through a mixed-method research approach, the research explores the barriers to ICT usage within Saudi Arabian libraries.

### **1.1 Research significance**

The significance of the research lies in addressing a significant gap in the existing literature research, hence precisely understanding the impact of ICT-based library services on students' learning and educational goals at the higher education institutes of Saudi Arabia. Therefore, the research aims to bridge the gap between conventional library settings in Saudi Arabian universities by integrating ICT-based library services. Examining and exploring the students' perceptions and attitudes toward using ICT-based services underscores the critical areas of improvement for future research [8]. The student satisfaction level after implementing ICT-based library services provides actionable insights and values for university administrators, policymakers, and instructors in executing ICT-based library services through a user-centric approach. Furthermore, the study adheres to Saudi Vision 2030, emphasizing the digitalization of educational services in Saudi Arabian universities [9].

Additionally, integrating ICT-based library services in Saudi Arabian universities provides a unique cultural context in the education system, offering valuable perspectives that bridge the gap between conventional library practices and the advanced technology of ICT-based learning pedagogies. Furthermore, the research outcomes aim to address and underscore the pertinence of Saudi Arabian universities in acknowledging the Saudi Vision 2030 and elevating the educational setting in Saudi Arabia.

### **1.2 Problem statement**

Numerous studies comprehend the barriers to incorporating ICT-based library services in Saudi Arabia, considering these services the main driving force for e-learning initiatives [10,11]. Despite the growing presence of ICT resources worldwide, Saudi

Arabian higher education students are yet unaware of the advantages of ICT-based library services and their implementation within digitally transformed physical libraries. Hence, due to a lack of knowledge and inadequate understanding of the correct resource usage, students significantly lack proper training in adapting to newer technology.

Moreover, educators remain unequipped and uninformed of the accurate usage of ICT-based library services. These consequences hinder the university's ability to benefit from the technology and its capabilities in upgrading the conventional education dynamics of the Saudi Arabian higher education system. Hence, the research aims to provide the students' perception of ICT usage in libraries, which develops as a key framework for university administrators and librarians delving into actionable insights that assist in upgrading and leveraging ICT usage across Saudi Arabian libraries.

### **1.3 Research objectives**

1. To explore the current state of ICT integration in Saudi Arabian universities.
2. To evaluate the user perception and barriers to ICT-based library services in Saudi universities.

## **2 LITERATURE REVIEW**

### **2.1 Theoretical framework**

In today's world, information is created, gathered, and organized through the knowledgeable usage of technological resources in universities and libraries. In Saudi Arabian education, the term library has significantly evolved from a physical structure to digital and virtual environments, making access to educational resources [12]. The diffusion of innovation (DoI) theory is essential to improving social practices to perceive high-quality information about newer ideas or innovations integrated into Saudia Arab.

According to Rogers and Scott (1997), the implementation of the DoI has been rapidly increasing as the conventional educational dynamics are improving with the adoption of innovative and advanced technology, such as the advent of the Internet and other technology-based learning and associated facilities. Hence, the theory supports the

research objectives and the integration of ICT in Saudi Arabian universities over time [13].

## **2.2 Significance of utilizing ICT In university libraries**

The conventional setting of libraries lacks extensive knowledge of different curricula, recent research, and exclusive innovations across the globe. Moreover, the libraries of developed countries are now integrating ICT to offer their students circulation, classification, learning acquisition, and easy access to electronic content such as books, websites, journals, and other powerful resources. According to Essien et al. (2022), apart from the numerous advanced benefits, ICT-based learning services provide leverage to the learners as well as educators in exploring the tremendous ways of learning complex topics with the help of visuals and attractive content [14].

Similarly, remote libraries also provide opportunities for people to engage in different online activities and for international participants, which eventually help polish personal and professional skills. Additionally, apart from students, ICT-based library services facilitate employees associated with libraries, such as university administration and librarians, to reduce workload and provide efficient ways to deal with students utilizing library services. The innovative and technological advancements empowered by ICT integration are not only effective for academic libraries, but they also entail the ability to transform the traditional educational dynamics of the whole nation. Likewise, developing countries like China, India, Africa, and Saudi Arabia look forward to integrating ICT-based library services in their higher educational settings.

## **2.3 Previous studies on ICT In Libraries**

The study by Shanmugamoorthy et al. (2013) stated that libraries are repositories of knowledge and are considered an integral source of education. The study's findings showed that 27.42% of students spend one to two hours per day searching and accessing the ICT-based technology and services provided by their university. Additionally, the results showed a 39.97% satisfaction level while using ICT-based resources, concluding that ICT-based library services were found to be an effective approach for university students [15].

Ahmad et al. (2020) examined the usage and impact of ICT-based library services among library professionals associated with the government degree colleges of Kashmir, India. However, the study's findings highlighted that ICT provides faster and more accurate services that significantly affect the role of librarians in handling their duties and responsibilities. Likewise, the study also showed that software such as OPAC, library automation SOUL software, and Barcode technology provide convenience to enhance work efficiency in the digital age [16].

Despite the exaggerated importance of ICT-based services in enhancing conventional library practices in Saudi Arabian universities, previous literature does not adherently explore students' perceptions and barriers towards ICT-based library services.

#### **2.4 Challenges in ICT-based Library Services**

Despite the positive features of ICT-based library services, several negative factors restrict the digital transformation in education across diverse cultural contexts. According to AlAmri (2019), the Saudi Arabian Ministry of Education has already reviewed ICT as an integral part of promoting quality education. However, the cultural norms of Saudi Arabia play a negative role in promoting ICT among their students in education and other aspects of life [17].

Furthermore, the role of teachers and instructors was found to be judgmental because they do not consider content acquired from internet resources. The teachers prohibit the use of the Internet and AI-powered software to complete the students' assignments. Additionally, the practice of adopting ICT in education can be found to be sophisticated as it restricts the creativity and enthusiasm of students, making them dependent on the Internet and other digital resources [11].

According to Benjamin et al. (2022), fewer researchers categorized intrinsic and extrinsic barriers as incomplete resources, unstable network connections, heavy workloads, budget issues, and privacy concerns. However, the above-mentioned issues and challenges were more exaggerated in the qualitative phase of the study, where the respondents shared valuable insights and first-hand experiences of ICT-based library services in Saudi Arabian universities [18]. Similarly, other barriers to ICT adoption in Saudi universities are multifaceted and discussed in the studies of Lund et al. (2021) and Alomari et al. (2023) [19, 20]. However, the students faced repetitive challenges,

including comprehensive training programs for university students and staff. Additionally, the infrastructure in most universities, particularly in remote areas, is often inadequate to support advanced digital tools, which results in an overall slower internet speed, unreliable access to online resources, and frustration among higher education students.

### **3 METHODOLOGY**

#### **3.1 Research design**

The research utilized a mixed-method research design, adopting a quantitative and qualitative approach to evaluating the user perception and barriers faced by Saudi Arabian universities in utilizing ICT-based library services. According to Dawadi, Shrestha, and Giri (2021), the mixed-method research design is appropriate for exploring and analyzing respondents' perceptions, especially in instances where the research involves multiple stakeholders to address the research objectives [21].

Additionally, the mixed-method research design utilized three survey questionnaires and six in-depth, semi-structured interview questions to investigate the user perception regarding ICT awareness and integration in university library services and educational dynamics. The findings of the quantitative and qualitative assessments aim to provide deeper and more valuable insights to showcase the apt utilization of ICT across libraries and educational settings.

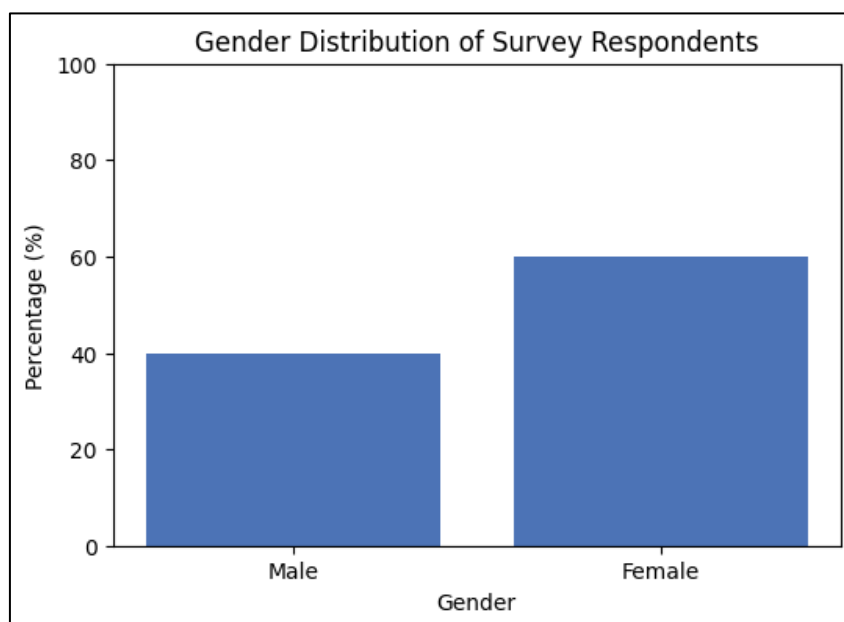
#### **3.2 Research participants**

The research involved 500 participants for quantitative analysis, who were selected from Saudi Arabian Universities, employing ICT-based library services. The respondents included 60% females and 40% males. Moreover, 55% of participants were enrolled in the second and third year of the university, while 30% and 15% were enrolled in the first and final year of their undergraduate degrees, respectively. Additionally, the participants were enrolled in a diverse range of academic disciplines, comprising Engineering (25%), Business (20%), Health Sciences (15%), Social Sciences (10%), and other fields (30%).

However, a larger sample size was selected to ensure reliable outcomes and to extensively address the students' perceptions and satisfaction levels with ICT-based library services. Additionally, the research intended to explore barriers and hindrances in implementing digital technology across libraries. In addition, the qualitative analysis involved 10 participants. They were interviewed through six in-depth semi-structured questions to investigate the impact of ICT-based library services on their learning capacity and academic achievements. Figure 1 and Table 1 show the demographic characteristics of the research participants.

**Figure 1:**

*Demographics Distribution of Respondents*



Source: Authors

**Table 1:**

*Educational Background of the Respondents*

Gender	Male, Female, Other
Year of Study	1st Year, 2nd Year, 3rd Year, 4th Year, Under-graduate.
Faculty/Department	Engineering, Business, Health Sciences, and Social Sciences.

Source: Authors

### 3.3 Sampling technique and Size

The participants were selected through a purposive sampling technique, allowing the researchers to involve multiple stakeholders' perceptions and satisfaction levels

regarding using ICT-based library services in Saudi Arabian universities. The research also included public and private sector universities and higher educational institutes across Saudi Arabia. A total of 10 universities were selected, representing a cross-section of the exclusive educational landscape of Saudi Arabian universities associated with the advanced technology of ICT-based library services. Furthermore, the public and private universities were selected from Urban and Rural areas of Saudi Arabia to ensure diversity in the data collection procedures.

### **3.4 Data collection instrument**

For the quantitative phase, the researcher adapted three survey questionnaires. The first questionnaire involved a 7-item Association of Research Libraries "LibQUAL" provided by the U.S. Department of Education Fund for the Improvement of Post-Secondary Education (FIPSE) by Library Services Quality Survey. (2003) [22]. Moreover, the research adapted the 7-item Library users' attitudes towards Virtual libraries and Information Services by Namugera et al. (2023) [23].

The 7-item Association of Research Libraries "LibQUAL" Survey aimed to assess the student perception of the usage of ICT-based library services, whereas the 7-item Library Users' Attitudes Towards Virtual Library and Information Services Survey assisted in exploring the satisfaction of students regarding the usage of ICT-based library services within Saudi Arabian Universities. In addition, the 19-item ICT-awareness survey questionnaire, adopted from Sakarkar D. S. (2022), helped assess the students' awareness regarding using ICT-based library services in Saudi Arabian universities.

Each survey questionnaire included variables such as students' perception and satisfaction with implementing ICT-based library services. Additionally, a 5-point Likert scale was utilized to evaluate the attitudes and opinions of the respondents per the items of the questionnaires. However, the respondents scored by following statements through the following values: 1. Strongly Disagree, 2. Disagree, 3. Neutral, 4. Agree, Strongly Agree.

### 3.5 Data analysis procedure

The data was collected within three months, and the survey questionnaire was emailed to the students from ten Saudi Arabian universities across the public and private sectors. The researcher utilized an online survey platform, allowing a high response rate, follow-up reminders, and anonymous responses to ensure a result in authenticity. Following data collection, the responses were analyzed through SPSS to assess the responses through descriptive statistics and correlation analysis.

Moreover, the qualitative assessment involved six in-depth, semi-structured interview questions, providing a transparent overview of student perceptions, attitudes, and levels of satisfaction with ICT-based library services. The responses from the qualitative data were gathered to develop themes for prospective thematic analysis. The thematic analysis assisted the researcher in exploring students' experiences, perceptions, and attitudes toward implementing ICT-based library services across Saudi Arabian universities. In addition, the participants' responses were encoded and transcribed to assess recurring concepts and ideas stated by the respondents.

### 3.6 Questionnaire reliability

Cronbach's Alpha reliability test was implemented on the survey responses to assess the reliability and consistency of the survey questionnaire. However, the study used two survey questionnaires to investigate the user perception and barriers to post-ICT integration in library services. According to Ong (2012), the reliability of the questionnaire ensures the consistency of the survey items with the measured results [24]. The reliability of the survey questionnaire implemented in the current research was found to be 0.739, considered reliable and suitable to fulfill the research purpose.

**Table 2:**

*Reliability and Validity of Questionnaire*

Reliability Statistics	
Cronbach's Alpha	N of Items
0.739	14

Source: Authors

## 4 RESULTS

### 4.1 Quantitative analysis

**Table 3:**

*Correlation Analysis of Student Perceptions, Student Satisfaction, and ICT awareness on utilizing ICT-based Library Services in Saudi Arabian Universities*

Correlations				
		Student Perception	Student Satisfaction	ICT Awareness
Student Perception	Pearson Correlation	1	0.120**	0.827**
	Sig. (2-tailed)		0.007	0.000
	N	500	500	500
Student Satisfaction	Pearson Correlation	0.120**	1	0.096*
	Sig. (2-tailed)	0.007		0.032
	N	500	500	500
ICT Awareness	Pearson Correlation	0.827**	0.096*	1
	Sig. (2-tailed)	0.000	0.032	
	N	500	500	500
**. Correlation is significant at the 0.01 level (2-tailed).				
*. Correlation is significant at the 0.05 level (2-tailed).				

Source: Authors

Table 3 shows the correlation analysis between student perception, student satisfaction, and ICT awareness of Saudi Arabian University students regarding using ICT-based library services. The results indicate that the correlation between student perception and student satisfaction is 0.120, at p-value = 0.007, indicating a positive yet weak correlation between student perception and student satisfaction towards ICT-based library services in Saudi Arabian universities. Moreover, student satisfaction and ICT awareness show a weak positive correlation: 0.096 at p-value = 0.032. However, the strongest correlation between student perception and ICT awareness is determined at 0.827, p-value 0.000. This shows that a higher level of student perception towards ICT-based library services indicates greater awareness of ICT utilization within Saudi Arabian universities' library services.

**Table 4:**

*Regression Analysis on Student Satisfaction, Student Perception, and ICT Awareness on ICT-based Library Services*

ANOVA <sup>a</sup>					
Model	Sum of Squares	df	Mean Square	F	Sig.

	<b>Regression</b>	4.989	2	2.494	3.622	0.027 <sup>b</sup>
	<b>Residual</b>	342.283	497	.689		
	<b>Total</b>	<b>347.272</b>	<b>499</b>			
a. Dependent Variable: Student Satisfaction						
b. Predictors: (Constant), ICT Awareness, Student Perception						

Source: Authors

Table 4 shows the regression analysis on student satisfaction, perception, and ICT awareness of ICT-based library services. The results show that the F-statistics at 3.622 and p-value 0.027 suggest that student perception and ICT awareness are good predictors of student satisfaction. Hence, a change in student perception and ICT awareness may enhance students' satisfaction level regarding using ICT-based library services in Saudi Arabian Universities.

## 4.2 Thematic analysis

### 4.2.1 Theme 1: ICT awareness and usage

The qualitative analysis revealed significant insights into the students' perceptions regarding the usage and awareness of ICT-based library services. Most students mentioned that they were aware of the ICT-based library services offered by their universities. In contrast, fewer students also stated that integrating ICT-based library services was a newer and more advanced technology, which they were uninformed about and unaware of.

However, most of the students were found either infrequently using the library services, with most of them being the least knowledgeable. One of the students mentioned,

*"I've seen most of my friends come to the library to either chit-chat or bunk their classes rather than efficiently utilizing their time off using the ICT-based library services offered to them. I feel that the students should be made aware of the services provided to them to understand the importance of technology-led, effective learning."*

Another student mentioned,

*"The most common ICT resources I have utilized are digital books, online journal databases, and library catalogs provided by the university's ICT-based libraries. These services have helped me learn even better and achieve better academic goals."*

Additionally, the students were asked about their satisfaction with these services. Most of the respondents who used the ICT-based library services were moderately satisfied, with only 25% of respondents showing satisfaction with the university's services. Hence, the library administration adhered to the students' negative feedback and aimed to constructively assess the service lacking to enhance user satisfaction. The negative feedback also indicated that the students found the digital resources difficult to navigate or access due to an inadequate understanding of the apt usage of technology.

#### *4.2.2 Theme 2: ICT Barriers and challenges*

The barriers identified in the qualitative findings reflected common challenges in ICT adoption, both in Saudi Arabia and globally. Some of the students highlighted,

"I think the most common barriers to effectively using library services are slow internet, outdated infrastructure, unreliable access to resources, and lack of training sessions and knowledge about ICT-based library services."

Most of the students reported,

*"We feel that the university library lacks formal training for the librarians and the teachers concerning the programs and ICT-based services launched by the library. Moreover, the lack of training has created a barrier between the teacher and the students, so the teacher cannot impart knowledge. We feel the teachers need to become more proactive to effectively utilize the services and make the students learn the same."*

However, the students also reported that the lack of formal training programs created issues of understanding, as the teachers were unaware of the technology. This developed a barrier to transferring adequate knowledge to their students. Most students reported being potentially un-equipped to effectively use the available ICT tools. Hence, these barriers represent the pertinent gap in the higher education institutes within Saudi Arabia. Therefore, Saudi Arabian universities should recognize the importance of digitizing education, alongside investing in the training of correctly using ICT-based tools and technologies for efficient academic performance.

#### *4.2.3 Theme 3: suggestions for enhancing ICT-based Library Services*

By the end of the interview session, the respondents were asked to suggest effective strategies to enhance the use of students' ICT-based library services among students. The students were to provide valuable recommendations on how to better integrate technology within Saudi Arabian libraries. However, most of the participants provided similar feedback. The responses narrated and suggested improvements in the students' higher education system.

Most participants emphasized the need for structured training programs to familiarize students and teachers with available resources and effectively use digital tools. Similarly, the students recommended using enhanced infrastructure and demanding faster and more reliable internet connections, particularly for those who commute from rural areas or where access to digital technology is insignificant or limited.

Several students recommended developing, strategizing, and conducting enhanced communication and awareness campaigns within universities to increase and promote efforts toward effectively utilizing the available ICT services. The students mentioned,

“Universities can adopt email campaigns, posters, and orientation programs to enhance awareness and user perception using ICT-based library services.” Lastly, the students also recommended that the university administrations and policymakers recognize the importance of technical support to overcome the technological barriers, alongside recommending the creation of a dedicated technical support team to assist with hindrances and barriers to effectively using ICT-based resources and tools across Saudi Arabian Universities.

## **5 DISCUSSION**

Through a mixed-method approach, the research aims to explore the students' perception and satisfaction with using ICT-based library services across Saudi Arabian Universities. The results indicate a lesser significant association between student perception and student satisfaction, alongside student perception and ICT awareness. This indicates that the students' perception of using ICT-based library services was rather stark and needed much invigoration and enhancement. Furthermore, the results indicated a

rather strong relationship between student satisfaction and ICT awareness, indicating that the students' higher level of satisfaction aimed at increasing the awareness towards effectively using or utilizing ICT-based library services. It is essential to mention that despite the high level of ICT awareness among students, their perceptions towards the technology were mixed and negative, which helped the library assess what they were lacking and develop strategies to enhance user comfort and satisfaction with the services.

Moreover, the results also mention that the students' perceptions were weaker, with an increasing level of motivation and satisfaction towards the library services and the technology provided by the Saudi Arabian Libraries. It is, however, essential to strategize ways to enhance the students' perception regarding the usage of ICT-based library services. In addition, the qualitative analysis revealed the students' positive perceptions regarding using ICT-based library services. However, the students mentioned certain barriers and recommended certain solutions to enhance the usage of the library services and, likewise, the awareness of the students and the teachers on the technology. The university students, however, felt that the Saudi Arabian universities should develop and conduct campaigns and training sessions to dialect and impart the effective use of the technology so the students could access more information, besides enhancing their learning and achieving their academic targets and goals.

Hence, the results of the current research moderately align with the results of Chamy and Ramalingam (2014), indicating that 24.22% of respondents reported that the library staff is highly essential to dialect the awareness of ICT among students. Moreover, a lesser majority of respondents had significant access to ICT-based resources. Furthermore, most respondents felt the need to construct computer labs to impart awareness and knowledge of ICT-based library services. However, ICT services have become vital in the 21st century, where the changing educational dynamics of learning and teaching should be supported with advanced technologies and computer applications [26].

Moreover, the result of the current research aligns with the results of Okonoko and Eruvwe (2021), indicating that most of the ICT-based resources were available across most of the libraries. Besides, the participants had sufficient awareness of the ICT tools using education programs and conferences to impart knowledge on the correct usage of ICT-based library services. Hence, the research recommended that the educational institute's authorities embark on capacity-building programs regarding the librarian's and

the library staff's training and re-training on ICT awareness [27]. Hence, the apt utilization of ICT-based technological resources within libraries is essential to imparting and enhancing education and learning capacity in Saudi Arabian universities.

The results of the current study underscore significant implications for both university administrators and policymakers. The findings underscore investing in ICT infrastructure across areas that possess limited access to high-speed Internet. However, ICT-based library services may not be fully implemented in case of an unreliable infrastructure. Universities must prioritize user training to enhance awareness and usage, including the incorporation of training programs, creation of user guides, and organizing workshops for students to develop digital literacy skills to effectively navigate ICT resources. The research highlights the essentialism of communication and outreach. However, universities should implement training campaigns to raise awareness on the available ICT services, which involve email newsletters, campus events, and social media as effective platforms to inform students on the usage of newer technological resources for effective learning.

## 6 CONCLUSION

This study examined the usage and perceptions of ICT-based library services in universities across Saudi Arabia, focusing on understanding the level of student engagement with IT-based technologies and the barriers that hinder the effective utilization of library resources. The results reveal both progress and challenges in adopting ICT in academic libraries, underscoring the need for continuous improvement in infrastructure, user education, and communication efforts. While most students have significant awareness of ICT resources, their actual usage is limited by factors such as outdated infrastructure, insufficient training, and a lack of awareness of the services offered.

The research findings implicate a significant gap between students' awareness of ICT-based library services and their ability to effectively utilize such resources, highlighting the need for universities to invest in user education and support. Hence, universities should prioritize investing in infrastructure to ensure fast and reliable internet access, particularly in remote areas. Moreover, user education should be enhanced

through training programs, workshops, and digital literacy campaigns that empower students to fully utilize ICT resources.

In addition, improving communication and awareness through diverse channels is essential to inform students about the available ICT services and the effective ways to access such services. Ultimately, this study contributes to the growing knowledge of ICT adoption in academic libraries, providing a valuable foundation for future research and improvements in library services. Further studies could explore the perspectives of library staff and faculty members and investigate the impact of improved ICT infrastructure and training programs on student engagement and academic performance. By addressing the barriers identified in this study, universities can create more inclusive and effective ICT-based library services, helping students to better engage with digital resources and ultimately improving their academic success.

### **6.1 Research limitations**

1. The research is limited to a smaller sample size, selected from different universities. However, the selection may not fully represent the diversity of students across the country. It is recommended that future research extend the sample size and include universities from different regions of Saudi Arabia to get a more comprehensive view.
2. The research is limited to assessing the students' perceptions and awareness of ICT usage while utilizing ICT-based library services across Saudi Arabian Universities. It is recommended that the researcher focus on examining the perspectives of librarians and faculty members to gain knowledge and perceptions from them.
3. The research is limited to understanding the perception of library staff on the usage and adoption of ICT-based services alongside barriers that hinder the apt utilization of resources. Moreover, and the improved strategies they have applied to engage students in availing library services.

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**Authors' Contribution**

Both authors contributed equally to the development of this article.

**Data availability**

All datasets relevant to this study's findings are fully available within the article.

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