

Barriers to the Effective Use of Technology in Higher Education Institutions in Yemen: A Case Study of Engineering Colleges

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Abstract

Technology promises to shape new education systems with modern features that accommodate the shortcomings of traditional systems. This study aims to answer these questions: Are Higher Education Institutions (HEIs) in Yemen, Taiz state, prepared to accept technology-based education (TBE) and what are the main challenges for that? 5-point Likert scale questionnaires targeted 221 female engineering students and 87 faculty members from public and private universities in Taiz state, while the survey data were statistically analyzed using SPSS software 23. The study examined many related variables such as skills to use and availability of technology devices, having personal laptops or smartphones, social beliefs, students' self-motivation, and institutions' vision and infrastructures. The results demonstrated that students exhibit better involvement with TBE than faculty members, while students' low income and social barriers represent a solid obstruction to the employment of online and blended education technologies in Yemen. The results also indicate that about 30% of the participant in Yemen did not have personal laptops. Besides, HEIs' infrastructure, such as smart classrooms, electricity, Internet, administrative structure, and scientific research incentives suggest that universities are incompatible with TBE. Finally, this study addressed the impact of cost-free social media platforms in enhancing students' academic attainments. implications for government, HEIs, faculty members, and students were recorded.

Keywords: Technology-based education; Academic Achievement; Social Media Platforms; Education Platforms.

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معوقات الاستخدام الفعال للتكنولوجيا في مؤسسات التعليم العالي في اليمن: دراسة حالة كليات الهندسة

الملخص

تعد التكنولوجيا بتشكيل أنظمة تعليمية جديدة ذات ميزات حديثة تستوعب أوجه القصور في الأنظمة التقليدية. تهدف هذه الدراسة إلى الإجابة على هذه الأسئلة: هل مؤسسات التعليم العالي في اليمن، ولاية تعز، مستعدة لقبول التعليم القائم على التكنولوجيا (TBE) وما هي التحديات الرئيسية لذلك؟ استهدفت استبيانات مقياس ليكرت المكون من 5 نقاط 221 طالبة هندسة و 87 عضو هيئة تدريس من الجامعات الحكومية والخاصة في ولاية تعز، في حين تم تحليل بيانات المسح إحصائياً باستخدام برنامج SPSS 23. وقد تناولت الدراسة العديد من المتغيرات ذات الصلة مثل مهارات الاستخدام ومدى توفرها. أجهزة التكنولوجيا، ووجود أجهزة الكمبيوتر المحمولة أو الهواتف الذكية الشخصية، والمعتقدات الاجتماعية، والتحفيز الذاتي لدى الطلاب، ورؤية المؤسسات والبنية التحتية. أظهرت النتائج أن الطلاب يظهرون مشاركة أفضل مع TBE من أعضاء هيئة التدريس، في حين أن الدخل المنخفض للطلاب والحوافز الاجتماعية تمثل عائقاً قوياً أمام توظيف تقنيات التعليم عبر الإنترنت والمختلط في اليمن. كما تشير النتائج إلى أن حوالي 30% من المشاركين في اليمن لم يكن لديهم أجهزة كمبيوتر محمولة شخصية. علاوة على ذلك، فإن البنية التحتية لمؤسسات التعليم العالي، مثل الفصول الدراسية الذكية، والكهرباء، والإنترنت، والهيكل الإداري، وحوافز البحث العلمي، تشير إلى أن الجامعات غير متوافقة مع TBE. أخيراً، تناولت هذه الدراسة تأثير منصات التواصل الاجتماعي المجانية في تعزيز التحصيل الأكاديمي للطلاب. وتم تسجيل الآثار المترتبة على الحكومة ومؤسسات التعليم العالي وأعضاء هيئة التدريس والطلاب.

الكلمات المفتاحية: التعليم المبني على التكنولوجيا؛ إنجاز أكاديمي؛ منصات التواصل الاجتماعي؛ منصات التعليم

Introduction

Technology has become an integral part that changes the way of today's daily life, and its integration into education system is a compulsory and complicated process [1]. In particular, technology is the fuel for initiating and widening distance, online, and blended learning, in which the educational process is conducted with new technologies that enhance education quality [2]. Digital technologies embedded in computers, smart phones, digital media tools, simulations, and web communities have revolutionized our thinking about learning and education. Technology transferred learning gadgets out of educational institutions to be available everywhere, at homes, workplaces, libraries, and so on. Of note, in this study, the term "technology" is related to information and communication technology that can be implemented in HEIs classrooms or used as hand-held devices, such as smartphones, laptops, tablets, etc. [3].

With the development of technology-driven learning, conveying knowledge has become easy, effective, and convenient. TBE promises to strengthen, accelerate, and motivate students to enhance their knowledge, skills, and experiences that efficiently qualify them for future careers and scale up their economic situation [4]. Furthermore, a recent research article suggests that Artificial Intelligence techniques can promptly enhance education [5]. One fundamental challenge is that people don't recognize what is technology and how it is complex and dynamic in nature. Integrating technology into education system cannot be implemented with isolation from nearby circumference influences such as social, economic, and cultural norms. Another fundamental barrier to employing TBE is that few have enough skills to use or access technology. There should be a perfect enough education system to accept integration with

technology [6]. Furthermore, TBE requires infrastructure and quality networks. Therefore, the use of technology in education should be updated with the rapid developments in communication and computing devices.

The ability to change students' thoughts so that they are innately self-motivated enough to rely on themselves in study and are relatively able to adapt to the full/partial replacement of face-to-face education with online education [7]. In a recent study conducted in UK, it is found that high grades students show higher motivation and engagement with TBE [2].

Before implementing TBE, lecturers and students must be motivated enough to accept it. Students and academic staff who live in bad socioeconomic situations face difficulties that slow the process of accepting TBE. Besides, the nature of the topics dramatically influences students' choices. Students of science, technology, engineering, and math (STEM) topics prefer to study using pen and whiteboard instead of power presentation techniques. They believe that writing on the board allows students to understand their lectures step by step, except for topics that have illustrating pictures and diagrams.

Online education lacks the body language and rhetorical presentation in lectures as it does in the case of face-to-face education [3]. Instead, online education provides flexibility in selecting highly qualified lecturers. Lecturers in online education prepare their lectures better than face-to-face. Lecturers in online lectures are closely monitored by the administration and their lectures are recorded and a copy is kept for evaluation. Online education is not officially authenticated and suffers from legal accreditation in many countries worldwide [6]. Blended learning is defined as a combination of face-to-face and online education [8]. It has become a recognized education system in many countries worldwide, especially after the 2020

year when the COVID-19 epidemic attacked the world and many universities applied emergency policies that officially allow online and blended education [6].

Recently, a quick increase in online-learning enrollments has been obtained, plausibly due to rapid technological development and, in particular, widespread access to the Internet. Again, due to the COVID19 epidemic, e-learning has become an official learning approach that invaded universities worldwide [6].

One dark side of the impact of TBE is the large decline in writing skills within learners. Additionally, many specific technologies are used for exam cheating, illegal trades, and so on. Furthermore, students waste large time with phone games, social media platforms, etc. However, these negatives do not affect the necessity of introducing technology into education systems.

One measure is to indicate whether students have laptops, smartphones, or tablets. In two studies conducted in many German universities between 2012 and 2021, the number of students who had smartphones increased from 56% to 96%. Furthermore, students who owned laptops have increased from 86% in 2012 to 94% in 2021. Finally, the number of undergraduate students who had tablets/PCs have increased from 9% in 2012 to 45% in 2021 [7]. In a recent study conducted at four German Universities, the results indicated that all respondents either have laptops (94%) or smartphones (96%), and therefore they are prepared for digital-based education [7]. For that, having a laptop or smartphone for students is a critical variable to engaging in TBE.

Social media sites are a class of Internet-driven applications constructed based on modern technological advancements in web networks [9-10]. It promises to change the hierarchy of people's needs and priorities, making

communication and interaction with surrounding people easy and convenient. The platforms offered by social media networks help users utilize them in education to enhance student's academic attainment [1,11,12]. Of course, using social media sites in education creates tension-free and stunning learning media that can enhance motivation, nosiness, interactive, and engagement of students [6, 9,11,13]. However, not all social media platforms boost academic attainment; reports indicated that Facebook use hurts students' GPAs and that low grades students had more engagement with Facebook [14].

HEIs in almost all countries have implemented TBE at all levels of study, while their focus now is how to measure the performance of TBE and its consequences. The situation in Yemen is entirely different, and the pressing questions are: Are HEIs in Yemen prepared to accept TBE? And what are the most critical challenges and barriers to implementing TBE in Yemeni HEIs? This work intends to address these questions in the low-income, conservative, and unstable Yemeni society and suggest policies and recommendations to students, educators, and HEIs.

Motivation

In the recent past, almost all countries tended to apply TBE and set adequate budgets for its implementation in the HEIs. Indeed, many countries have exercised TBE in primary and secondary schools, so its application in universities became a simple task. However, the situation in Yemen remains entirely different, and the country has witnessed economic and political crises for decades, which ended in a civil war that lasted for nearly a decade. Generally, the education system is the most affected sector in the country and the most serious field negatively impacting the future of generations. Mainly, higher education in the country was divided into two different systems;

the faculty members' salaries were terminated, and most qualified academic staff members leaked out of Yemen, which led to a noticeable decline in the higher education outputs in all universities, without exception.

With the expansion and lengthy period of war, it has become imperative for HEIs to seriously consider taking policies that raise the score of Yemeni universities and keep them at the same level as other universities in the region. Accordingly, Yemeni universities must direct their vision toward implementing TBE and supply them with all required infrastructures and facilities. This study is an attempt to examine if HEIs in Yemen are preparing themselves to accept TBE. It employed questionnaires to the university students and faculty members to assess this problem and suggest solutions to speed up the engagement of universities in TBE.

Methodology

The present study implemented a mixed quantitative-qualitative methodology to assess the research questions. Two online questionnaires were constructed via Google forms and distributed to the targeted respondents. The first questionnaire targeted female engineering students from IT, Software engineering, and Computer networking and security departments in three universities in Taiz state, Yemen. Among these universities, one university is public, while the other two are private universities. The respondents cover all levels of study from the first year to the final year in the university. The second questionnaire targeted faculty members from the engineering colleges of the three specified universities. The sample size was 221 female engineering students, among them 130 are students from Taiz University (public), 68 students from Al Janad University (private), and 24 students from Alsaeed University (private). The three universities constitute IT (88 students) and networking and security departments (76

students), but software engineering (58 students) is an undergraduate program of Taiz University only. The respondents' sample is distributed on all studying levels starting from Level 1 (54 students), Level 2 (41 students), Level 3 (46 students), Level 4 (46 students), and Level 5 (35 students). Questionnaires were sent to students and faculty members via social media platforms and through direct filling in the classrooms.

We have selected female engineering students for two reasons: (1) students from engineering colleges with computer-related disciplines are the most undergraduate programs that are close to technology, and (2) female students were selected as respondents to specify the social and religious barriers of female students of the conservative society of Yemen to engage technology-based education. Therefore, this study aims to identify the university's internal and external challenges, including the undergraduate students' social, economic, and personal characteristics.

Many variables were examined through faculty members, female engineering students, or both options to identify whether Yemen's public and private universities are prepared to accept TBE or not. Personal attitudes such as having laptops, English level, and financial conditions are selected for students to validate students' readiness to accept TBE. Many other variables that examine universities' ability to satisfy TBE, such as Internet facilities, electricity connections, updated curriculums, computerized classrooms, computer laboratories, scientific research capabilities, etc. The faculties' sample size was 87; among them, 44 faculty members had Ph.D., 18 faculty members had master's degrees, and the other 25 faculty members were lecturers' assistants. The faculty members were asked many questions to validate their attitudes toward TBE. Besides, many other variables corresponding to

university infrastructures were examined by faculty members. These variables are, for example, scientific research budgets, administrative structures of the universities, etc. Many other rooted social habits can be treated as fundamental barriers for female students in TBE. One critical challenge is that female students should take prior permission from families and spouses to engage in TBE. Finally, the questionnaires also examined variables related to social media networking use, wasting time with social media, and utilizing it for studying purposes as bridging tools to the advanced educational technologies that are unavailable right now in HEIs in Yemen.

Results and Discussion

Table 1 elucidates the statistics data of female engineering student responses, which include

Table 1. *Descriptive statistics of female student respondents based upon Pearson linear analysis.*

Variable	N	Min	Max	Mean	Std. D.
Study level	221	1.00	5.00	2.83	1.39
Having Laptop	221	1.00	2.00	1.71	0.457
Financial condition	221	1.00	5.00	1.83	0.65
English level	221	1.00	5.00	3.16	1.07
Computer laboratory	221	1.00	5.00	2.49	1.26
Updated Curricula with Accreditation	221	1.00	5.00	3.64	1.085
Updated Curricula with technology	221	1.00	5.00	3.43	1.297
Electricity	221	1.00	5.00	3.33	1.204
Internet services	221	1.00	5.00	2.48	1.185
Computerized Classrooms	221	1.00	5.00	2.97	1.255
SM use	221	1.00	5.00	2.79	1.11
SM reduces costs of books	221	1.00	5.00	4.13	0.832
SM enhances communication	221	2.00	5.00	4.41	0.672
SM increases GPA	220	3.00	5.00	4.36	0.63
Education platforms increase GPA	220	1.00	5.00	3.85	0.922
Blended Education support	220	1.00	5.00	3.79	1.157
Online education support	221	1.00	5.00	3.63	1.135
The effective use of mobile in education	221	1.00	5.00	3.59	1.06
Student satisfaction to TBE	221	1.00	5.00	3.16	1.47
TBE wastes students' time and focus	220	1.00	5.00	3.05	0.97
TBE increases GPA	220	2.00	5.00	4.26	0.642
Smartphones replaces calculators	221	1.00	5.00	3.54	1.01
SM = Social media, TBE = Technology-Based Education					

the mean, standard deviation, sample size, and response range. The variables are in four directions: personal attitudes toward TBE, universities infrastructure, social media networks, and other issues and opinions. The personal characteristics corresponding to the TBE are having a laptop, the student's financial condition, and the English level. The mean result indicates that ~70% of female students have laptops and that about 30% of students in the specified specializations cannot access TBE efficiently. Furthermore, the student's financial condition (mean = 1.83) points out that most students belong to low-income families so their engagement with the TBE could be at risk. The English level of students is low (Mean = 3.16) which indicates that the usefulness of TBE could be minor.

The most crucial factor for accepting TBE in HEIs in Yemen is the university vision and infrastructure required to adopt TBE. HEIs must have 90% infrastructure at least to be ready for TBE. However, except for the updated curriculum, which scored slightly above average (mean = 3.64). It is clear from Table 1 that computer laboratories (mean = 2.49), internet facilities (mean = 2.48), electricity (mean = 3.33), and computerized classrooms (mean = 2.97) are below average. Accordingly, the current infrastructure does not offer sufficient use of TBE, especially with abundant technical requirements. Due to the absence of official education platforms in HEIs in Yemen, students and faculty members use social media groups for each course to communicate with students themselves and between students and lecturers (mean = 4.41). For that, the majority of students believe that social media platforms enhance educational performance (mean = 4.36) and reduce the costs of books and study accessories (mean = 4.13); Female student respondents support blended education and online education

and believe that educational platforms enhance students' academic attainment. Female students put a good impression that implementing TBE could enhance academic attainment (mean = 4.26). This prediction is in line with other studies [2,3].

Some other issues, such as whether their universities currently employ TBE, and the students' response was not optimistic (mean = 3.16). Additionally, students agree that smartphones relatively replaced the need for scientific calculators (mean = 3.54). In contrast, approximately half of students believe that TBE wastes students' time and focus (mean = 3.05). Table 2 records the responses of faculty members toward TBE in Yemeni universities. The questions were directed into two main categories: universities infrastructure and social media use in education. Almost all faculty members' responses are below that of students, as shown in Table 1. Faculty members declare that universities provide poor support scientific research (mean = 2.36) and have no budgets for scientific research (mean = 2.09).

Table 2. *Pearson's linear statistics analysis of faculty members respondents*

Descriptive Statistics					
Variable	N	Min.	Max.	Mean	Std. D.
Updated Curriculum for Accreditation	87	1.00	5.00	2.92	1.3
Updated Curricula with technology	87	1.00	5.00	3.14	1.12
Research encouragement	87	1.00	5.00	2.36	1.2
Research budgets	87	1.00	4.00	2.09	0.97
Internet facilities	87	1.00	5.00	2.72	1.34
administrative structure	87	1.00	5.00	3.14	1.17
Accept online education	87	1.00	5.00	2.77	1.26
Use education platforms	87	1.00	5.00	2.86	1.18
Use SM for communicating students	87	1.00	5.00	3.72	0.97
SM enhances education achievement	87	1.00	5.00	3.52	1.02

Furthermore, faculty members believe that the administrative structure of universities (mean = 3.14) is not strong enough to accept TBE. Besides, they agree that the engineering

programs have curricula that are not updated enough to adopt technology (mean = 3.14) and for academic accreditation (mean = 2.19). Finally, faculty members support that the

internet access provided in Yemeni universities is inadequate for TBE.

Unlike student responses, faculty members state that they did not use education platforms (mean = 2.86) and did not give their mobile numbers to their students. Furthermore, the majority of faculty members did not accept online education or blended education at all (mean = 2.77). Faculty members show pessimistic opinions regarding the infrastructure and research budgets provided by universities in Yemen currently. Importantly, faculty members believe that the universities administrative hierarchy is incomplete, which is an essential requirement for good administration.

The research team interviewed some professors who previously performed online education in Yemen and asked them many questions corresponding to TBE. In this regard, a civil engineering professor at Al Janad University, Taiz, Yemen, who has taught “Engineering Mechanic” course to second-year students through Face-to-Face education and for the next batch through online education. He confirmed that students cannot efficiently understand and memorize topics through online education, especially fresh students. He added “Students at final-levels can understand better than first-year students, and therefore universities in Yemen should not apply online education for undergraduate studies unless there are no specialist lecturers to teach students through face-to-face”. On the other hand, an industrial engineering professor, taught a “Product design” course to master students at Taiz University confirmed that master students present a better understanding and memorize their topics effectively, but the internet speed and electricity connections interrupt the connection. “Students who do not have laptops or smart phones cannot join online education at

home” he added. All in all, online education can officially be best applied to postgraduate and higher levels of undergraduate programs. Furthermore, universities should equip classrooms with TBE requirements and provide high-quality internet connections and speeds.

Table 3 elucidates the opinion of students and faculty respondents regarding many financial, social, and family-related issues. Of note, students’ readiness to accept TBE is much more than faculty members. The ability of faculty members (44.25%) to accept online education is much less than that of students (62.22%). Unlike faculty members (46.55%), students (71.06%) believe that education platforms are necessary to enhance academic attainment. Undoubtedly, TBE could transfer lecturers and textbooks from the only source of information in the HEIs to become perhaps secondary sources, where students now get their academic attainment from various online sources and self-studies. Therefore, the response of lecturers to TBE is slower, and they feel as if they lose part of their prestige in educational institutions. In the recent past, rapidly developed artificial intelligence technologies have motivated students to write well-structured reports and tutorials, self-answering complex problems, and sometimes update their information faster than their lecturers [15]. Importantly, one critical point from the students’ responses is that 64% of female students prefer lectures to be performed by traditional methods using marker and whiteboard. That is plausibly due to the nature of engineering courses requiring stepwise mathematical analysis on the board by face-to-face education. However, online education can provide these features of step-by-step education based on the lecturers’ willingness.

Table 3. A comparison between students' and lecturers' responses regarding many issues related to the TBE.

S. No	Variable	Evaluation (%)	
		Lecturers	Students
1	I agree to start online education in HEIs.	<u>44.25</u>	62.22
2	Educational platforms enhance education attainment	<u>46.55</u>	71.06
3	I prefer to take course online with specialist lecturer than face-to-face of non-specialist		69.5
4	We had Classrooms provided with internet facilities, electricity, and presentation show	<u>44.1</u>	<u>37.05</u>
5	Social media enhances communication with students and lecturers and makes it easy	68.1	84.87
6	Social media use increases academic attainments	62.93	83.67
7	Social media sites help reduce cost of books and other study materials		77.93
8	I can join social media groups that allow my mobile number to be shared with other classmates such as WhatsApp and Facebook groups.		<u>10.76</u>
9	I can join online video lectures on ZOOM or other platforms and my family has no problem		74.3
10	Universities had updated their curriculum to be suitable to accept TBE	54	60.6
11	Universities have new and complete administrative structures	53.45	
12	TBE enhances academic attainment		82
13	Mobiles-based education enhances education attainment and reduces costs		64.7
14	I prefer learning based on pen and whiteboard education rather than PPTs presentation		64
15	TBE reduces the need for scientific calculators and other tools, which reduces studying costs		63.65

Social barriers

Table 3 summarizes the opinions of female students regarding the social barriers that obstruct their engagement in the TBE. In this regard, Yemen has a conservative society that strictly obeys Islamic rules and inherited social habits. Implementing TBE often requires female students to share personal information and mobile numbers with classmates and lecturers. Few social media networks embedded privacy security tools suitable for such Yemeni society beliefs. In this regard as depicted in Table 3, the research team asked the female respondents a direct question if they accept to be members of educational social media groups that make their information and mobile number visible to all

group members. The responses of 221 respondents are shocking, in which only 10.76% of female students agreed to participate in educational platforms based on social media networks. The remaining 89.24% answered they should not participate in such groups with such features.

Another question was introduced to female students if they accept to participate in online video lectures through ZOOM or any other education platform based on co-education. About 53.15% of female respondents agree to participate in technology-based education. However, of the remaining participants: 16.67% declare that their family may reject that type of education, and 30.18% answered that they can't

participate in online education even if their families will agree.

One critical barrier for female students in Yemen is that many parents and spouses do not allow their females to join online team lectures or join any educational platform that requires to put their mobile number [17]. These critical issues will be investigated in this study. In this regard, Yemeni universities do not provide official educational platforms. Instead, students and lecturers use groups of WhatsApp and Telegram for each student's batch and sometimes for each course. Due to the co-education nature of HEIs in Yemen, many females refuse, based on their family's beliefs, to join WhatsApp groups due to the appearance of their mobile numbers to other male classmates.

Admirably, when students were asked about the best useful social media platform for their educational attainments, their answer unanimously indicated that Telegram is the best one. Of course, Telegram structurally, as an educational platform, has more privacies than other social media networks [9,11,13].

The research team conducted interviews with many female engineering graduates and students and came up with these plausible privacies and merits that can be summarized in, and not limited to, the following points:

- 1) Telegram gets its increased popularity when WhatsApp changed its privacy rules in 2021.
- 2) It offers no limits to members in organized group chats.
- 3) It provides secret chats that are end-to-end encryption.
- 4) It allows developers to create private bots for their chats.
- 5) It allows users to hide their personal information, mobile numbers, and profile photos.
- 6) It does not allow the other party to make screenshots for a chat if required.

7) It has reminder features to track students' assignments, tutorials, and exams.

8) It has access to educational resources and has the feature of file sharing.

9) It can deal with all data accessed by smart phones and computers.

To conclude, female students in Yemen rely on Telegram as the best free platform owing to its privacy and information security. It has many features that make it suitable for the Yemeni education environment. Furthermore, some faculty members establish a WhatsApp group for their course with their students; However, female students do not participate in such groups due to the privacy policies in WhatsApp that allow others to share others' mobile numbers, which is a prohibited behavior in Yemeni society.

Social Media share in TBE

It is impossible to discuss the impact of technology on education systems without including Social Media networks as a fundamental factor in this regard. Social media sites have made dramatic changes to the life of nowadays generations [16]. The results of this survey indicate that 95% of the Yemeni female respondents use WhatsApp, 74.1% Telegram, 52.73% Facebook, 44.54% Instagram, and 10.46% Twitter, as shown in Figure 1. Furthermore, the respondents indicate that Instagram, followed by Facebook and then WhatsApp are the most social media networks that waste their time and focus. These findings are in line with other results from the literature review [14,16]. Interestingly, Yemeni female engineering students elucidate that Telegram is the most useful educational platform for them. Female engineers point out that WhatsApp is the second social media network useful for their academic attainments. One strange result is that Yemeni people disfavor dealing with Twitter. They seldom use it or implement it for educational purposes, as depicted in Figure 1.

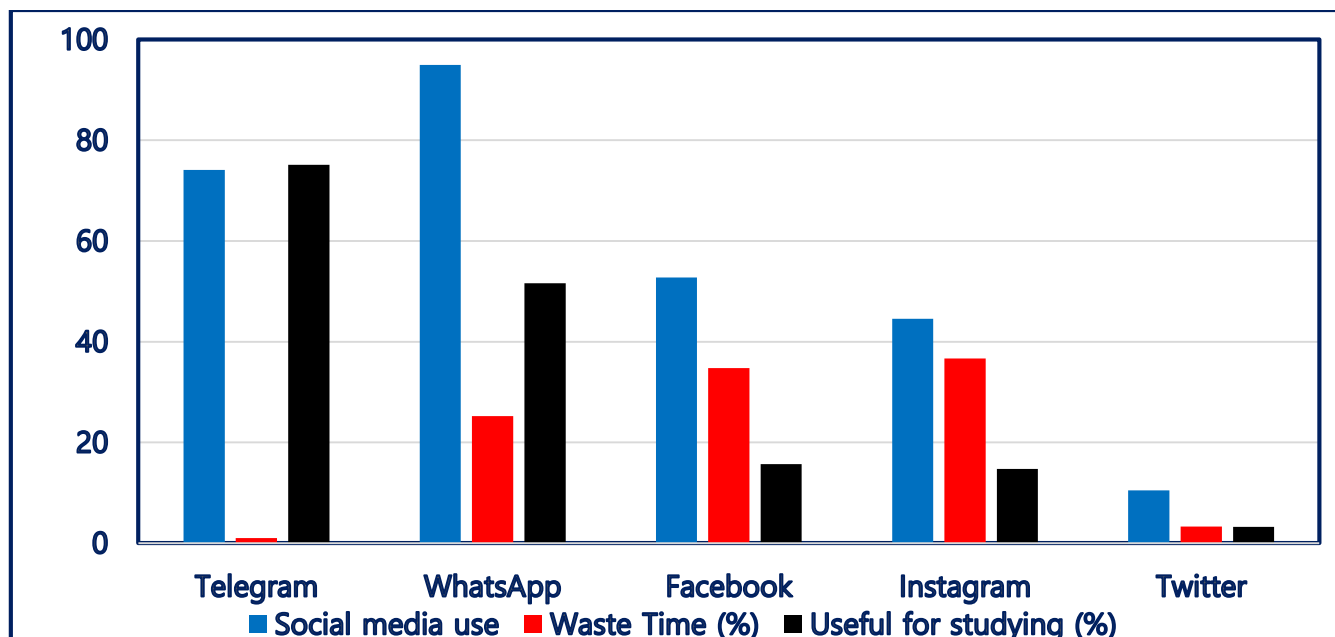


Figure 1. A histogram illustrates statistics of female engineering students' social media use, a source for time wasting, and a beneficial tool for their education.

Figure 2 depicts the personal characteristics that are required for individuals to engage TBE. These variables are 1) having a laptop, 2) student financial daily expenses, and 3) student English level. The findings indicate that 70.2% of students have laptops, 61% is the average English level while their financial conditions are low at ~21%.

From an economic point of view, the application of TBE is a double-edged sword. On one side, integrating technology in education for low-income students reinforces their academic attainments from various views; students who cannot attend classes can now ask their classmates to record videos for lectures, and later, they can memorize them at their homes. Furthermore, students who don't have the fees of hard copy of lecture materials can now read them as soft copies. Poor students can now use calculators on their mobiles instead of calculators. However, from the other view, universities that have accepted TBE require new infrastructures and may charge more fees. Undoubtedly, pushing low-income families

toward involvement in TBE could lead to even more poverty and exclusion and that could negatively affect their basic budgets allocated for food, health, and basic life requirements. It is compulsory for students who are enrolled in TBE to have laptops or smartphones, which is an additional burden on their families.

Again, the university infrastructures that are required by HEIs to efficiently engagement of TBE are 1) the availability of modern-technology computer laboratories, 2) curriculums updated to adhere to technology and accreditation, 3) classrooms provided with fast-Internet facilities, uncorrupted electricity, ventilation system, and digital presentation devices, and 4) university financially support scientific research. The respondents from public and private universities evaluate the adequacy of computer laboratories to accept TBE to be 32.45%, while the curricula were scored 60.6%. These results indicate that the selected Yemeni universities are equipped with old computer laboratories; Surely, the university with old computer laboratories is not ready to accommodate TBE.

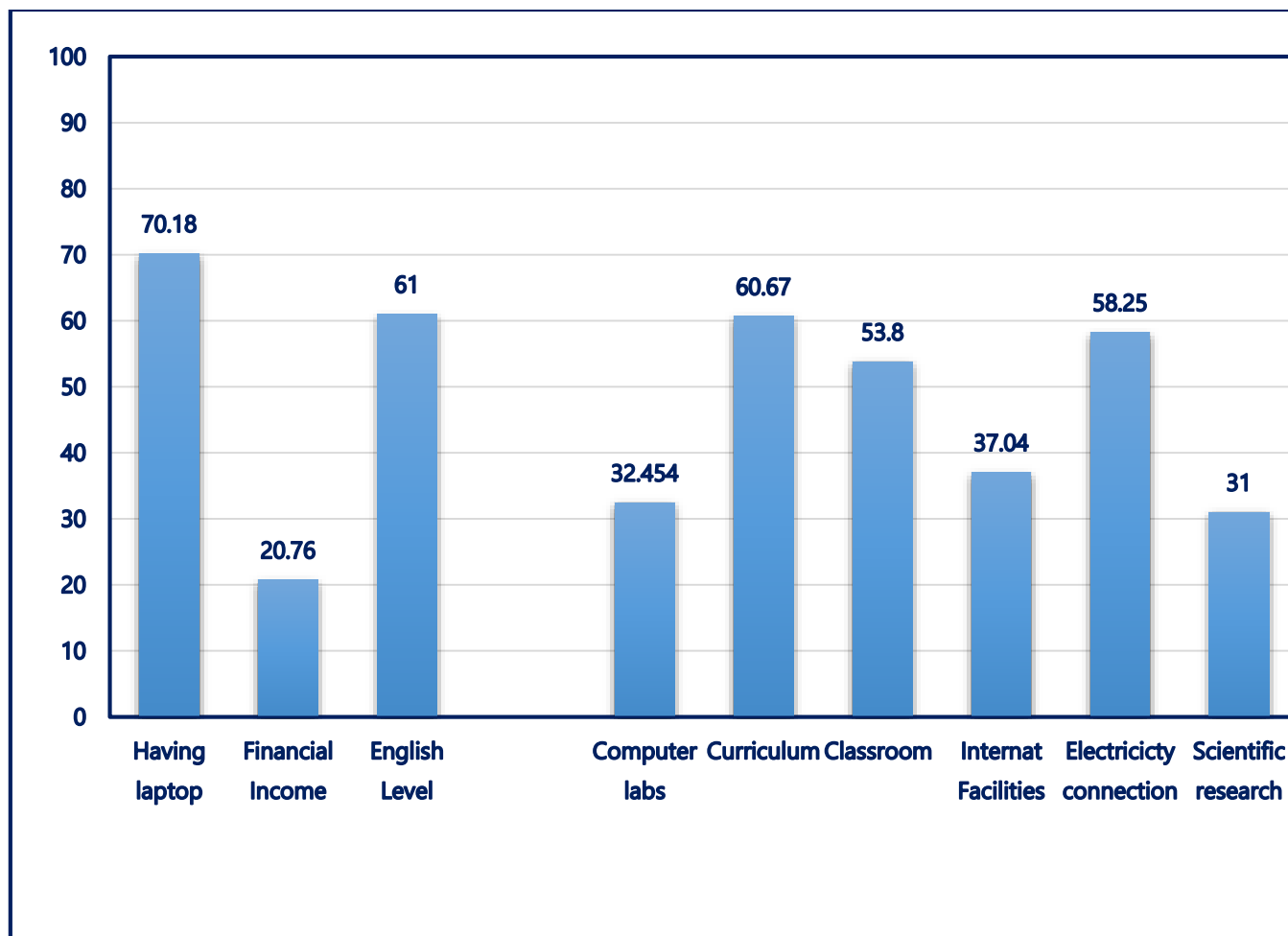


Figure 2. A histogram depicts the personal characteristics and universities infrastructure that are required for accommodating TBE.

Conclusions and Recommendations

This article summarized the most critical challenges to the integration of technology in the educational systems in Yemeni engineering colleges. Two surveys that targeted female engineering students and faculty members of three public and private universities in Yemen were constructed.

The results of this study revealed that universities should take steps to overcome barriers to amending education laws in Yemen to accept e-learning, distance education, and blended education. There are many pivotal factors to adapting to TBE in Yemeni HEIs; They are, for example, students' self-motivation, university infrastructures, institution's mission, and government facilities and services. The economic influences of

implementing TBE are magnified in the low-income society of Yemen. The results indicated that students must have specific characteristics that integrate them into TBE such that they must have self-motivation to study online, laptops or smartphones, good English background, and an adequate financial income. It is found that female engineering students prefer Telegram platforms to boost their learning due to their high privacy, high security, and more educational features.

Of note, social beliefs are crucial challenges that drastically influences female students' engagement in TBE. Families and spouses should loosen restrictions on female students to facilitate their integration into TBE. In addition, Yemeni universities should establish technology devices in educational systems

gradually. In other words, Ministry of Higher Education should take steps toward making blended education official as a first step, within 20-30% online courses in HEIs officially recognized, especially for higher levels where no specialists in Yemen. HEIs in Yemen must adopt sufficient budgets to accommodate TBE and modern teaching methods in their teaching systems. They should seriously provide their classrooms with secure and adequate infrastructures supplied with electricity, Internet, show presentation devices, ventilation systems, and so on.

Finally, free access to technology and technological literacy are substantial barriers in Yemen. Students should be provided with prerequisite courses to communicate easily and efficiently with educational platforms and online education. More importantly, faculty members also need to be engaged in condensed training courses to be familiar with online teaching and how to manage educational platforms. Furthermore, Yemeni universities should implement technology tools in educational systems gradually. Put simply, higher education ministry should take step toward making blended education officially as a first step.

References

- [1] M. Henderson, N. Selwyn, G. Finger, R. Aston, Students' everyday engagement with digital technology in university: Exploring patterns of use and usefulness. *J. Higher Education Policy and Management*, 37(3) (2015) 308–319.
- [2] T. J. Dunn, M. Kennedy, Technology Enhanced Learning in higher education; motivations, engagement and academic achievement, *Computers & Education* 137 (2019) 104–113.
- [3] A. Kirkwood, L. Price, Technology-enhanced learning and teaching in higher education: What is enhanced and how do we know? A critical literature reviews. *Learning, Media and Technology*, 39(1) (2014) 6–36.
- [4] M. D. B. Castro, G. M. Tumibay, A literature review: Efficacy of online learning courses for higher education institution using meta-analysis. *Edu. Infor. Techno.*, 26(2), (2021) 1367–1385.
- [5] X. Wang, L. Li, S. C. Tan, Lu Yang, J. Lei, preparing for AI-enhanced education: Conceptualizing and empirically examining teachers' AI readiness, *Computers in Human Behavior* 146 (2023) 1077.
- [6] I. Y. Alyoussef, Acceptance of e-learning in higher education: The role of task-technology fit with the information systems success model, *Heliyon* 9 (2023) e13751
- [7] M. Pumptow, T. Brahm, Students' Digital Media Self-Efficacy and Its Importance for Higher Education Institutions: Development and Validation of a Survey Instrument, *Technology, Knowledge and Learning* 26 (2021) 555–575.
- [8] Y. Zhonggen, Blended learning over decades, *Int. J. Information and Communication Technology Education* 11(3) (2015) 1–19.
- [9] F. J. Agbo, O. Olawumi, et al., Social Media Usage for Computing Education: The Effect of Tie Strength and Group Communication on Perceived Learning Outcome, *Int. J. Education and Development using Information and Communication Technology (IJEDICT)*, 16(1) (2020) 5-26.
- [10] A. M. Kaplan, M. Haenlein, Users of the world, unite! the challenges and opportunities of social media. *Bus. Horiz.* 53 (2010) 59–68.
- [11] Z. Zhao, X. Wang, S. M. Ismail, M. K. Hasan, A. Hashemifardnia, social media and academic success: Impacts of using telegram on foreign language motivation, foreign language anxiety, and attitude toward learning among EFL learners. *Front. Psychol.* 13 (2022) 996577.
- [12] Y. Zhang, L. Leung, A review of social networking service (SNS) research in

communication journals from 2006 to 2011. N. Media Soc. 17 (2015) 1007–1024.

[13] S. Sarvari, E. Ezzati, Teaching writing through telegram social network and its effect on EFL learners' writing performance. Int. J. Foreign Lang. Teach. Res. 7 (2019) 87–100.

[14] S. Feng, Y. K. Wong, L. Y. Wong, L. Hossain, The Internet and Facebook Usage on Academic Distraction of College Students, Computers & Education, 134 (2019) 41-49.

[15] R. Raja, P. C. Nagasubramani, Impact of modern technology in education, J. Applied and Advanced Research, 3(Suppl. 1) (2018) 33-35.

[16] A. Dhir, P. Kaur, S. Chen, S. Pallesen, Antecedents and consequences of social media fatigue, Int. J. Information Management 48 (2019) 193–202.

[17] H. Abdalnour, L. Abdulkhaliq, A. M. Ghaleb, M. A. Amrani, F. Alduais, Challenges to Female Engineers' Employment in the Conservative and Unstable Society of Taiz State, Yemen: A Survey Study. Sustainability 15 (2023) 14919.