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Achieving the 2030 Vision Tatweer Higher Education Policies in the Kingdom of Saudi Arabia: Challenges and Accomplishments in the Higher Education Information Technology Infrastructure

Abdullah Alsharari
Clark Atlanta University, abdullah2nouf@gmail.com

ABSTRACT

EDUCATIONAL LEADERSHIP

ALSHARARI, ABDULLAH B.A. AL JOUF UNIVERSITY, 2008

M.A. YARMOUK UNIVERSITY, 2013

ACHIEVING THE 2030 VISION TATWEER HIGHER EDUCATION POLICIES IN THE KINGDOM OF SAUDI ARABIA: CHALLENGES AND ACCOMPLISHMENTS IN THE HIGHER EDUCATION INFORMATION TECHNOLOGY INFRASTRUCTURE

Committee Chair: Daniel Teodorescu, Ph.D.

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This study examined the satisfaction with and use of technology infrastructure by students and faculty across a sample of five universities in the Kingdom of Saudi Arabia. Overall, the findings indicated that both faculty and students were relatively satisfied with the information technology (IT) infrastructure at their respective campuses, although they tend to report satisfaction levels more than faculty or students in the United States. The study also revealed several areas of improvement, including the need for more reliable Wi-Fi networks on campuses and for the use of Learning Management Systems (LMS) and other digital technologies by the instructors. The analysis uncovered disparities in the overall experience of faculty and students with IT between universities located in the capital city and universities outside the capital city.

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LIST OF ABBREVIATIONS

ECI	Economic Complexity Index
EDUCAUSE/ECAR	EDUCAUSE Center for Applied Research
IT	Information Technology
KSA	Kingdom of Saudi Arabia
LMS	Learning Management Systems
OECD	Organization for Economic Co-operation and Development
PEEC	Public Education Evaluation Commission
RQ	Research Question
SACM	Saudi Arabian Cultural Mission
SES	Socioeconomic Status
SPSS	Statistical Package for the Social Sciences
STEM	Science, Technology, Engineering, and Mathematics
TATWEER	Public Education Development Project
TPCK	Technological Pedagogical Content Knowledge

CHAPTER I

INTRODUCTION

The higher education system in the Kingdom of Saudi Arabia (KSA) experienced and developed to its current maturity through many generational progressions. Solely adapted and implemented by the Supreme Council on Higher Education under the auspices of the Kingdom's Ministry of Education, the transformational initiatives enacted by the late King Abdullah Bin Abdul-Aziz are the most recent key initiatives. King Abdullah's initiatives, also known as the Public Education Development Project (Tatweer) and Public Education Evaluation Commission (PEEC) (2016) occupy a large portion of the current Kingdom's Vision 2030.

Visions 2030 was initiated by the government of Saudi Arabia in early 2016 as a way of bringing the Kingdom's educational development to keep up with global educational innovations. The Tatweer initiative serves a mechanism to enable the Kingdom to hold its competitive edge in many areas of the Saudi societal changes and allow openness to the global village.

Vision 2030 and the Tatweer initiatives provided the Kingdom the opportunity to adapt the higher educational system by focusing on eight separately linked strategic goals and plans. These plans were initiated to modernize and transform the Kingdom's higher education educational system and policies. This study evaluated the challenges and accomplishments of Vision 2030 and the Tatweer initiatives in the areas of technology

infrastructure as viewed by faculty and students in five universities the Kingdom of Saudi Arabia.

Through a comprehensive quantitative study, the researcher investigated the important factors related to the implementation of the Tatweer initiative and its impact on society. The concepts of a quantitative research methodology enabled the researcher to garner adequate dataset through surveys of individual student and faculty experiences from Saudi Arabian higher educational institutions. The research also garnered data through surveys in pre-approved questions that further investigated the study's viability for the implementation of the Vision 2030 and the Tatweer initiatives.

The research topic enabled the researcher to study the impact of higher educational initiatives in the Kingdom and its opportunities to close the gaps in technological advancement that exist based on gender, socioeconomic (SES) and geographic locations. Cooper (2006) stated that individual student's ability to compete aggressively will frame and reveal if any gaps exist.

The Kingdom's recent experience with Tatweer was examined in the context of gender gaps as well as regional gaps in technological advancements. The researcher also studied the Tatweer and Vision 2030 initiatives through the prism of fair distribution of technological advancements across various universities in the Kingdom.

Statement of the Problem

The Kingdom of Saudi Arabia understands that the new millennium and the global oneness will have greater implications on many aspects of the Saudi lives, ranging from technology, education, healthcare, social make-ups, and business transactions. The

ability of the Kingdom to remain competitive globally will be determined by the successful culmination of its higher educational initiatives. Levin and Wadmany (2008) stated that for many global nations to adhere and maintain their educational attainments in the 21st century, incorporating technological advancements must take a lead role.

The Kingdom of Saudi Arabia understands that incorporating technological advancement in their new initiatives for higher education will effectively benefit the advancement of their educational systems and provide an edge in global and regional competitiveness. This advancement will occur through providing quality oriented learning orientations, advanced and modern curriculum developments based on research methodologies, and providing sustainable and accessible educational attainments for all Saudi higher educational students (Ghasemi & Hashemi, 2011). The Organization for Economic Co-operation and Development (OECD) (2011) noted that to keep up with global advancement many developed and under developed nations are taking the lead to meticulously and systematically incorporate information technology in their educational strategies.

Tatweer Co for Educational Services (2010) stated that that the Kingdom of Saudi Arabia realizes the importance of incorporating information technology in their main core higher educational institutions to enable students and professional personnel to access and provide their students digitally accessible integrations. This requires a vast investment by the Tatweer initiatives in information technology. The initiatives of the Tatweer Public Educational Development Projects enacted by the late King Abdullah

carry a price tag of $2.4 billion dollars for technology-oriented educational attainments (Tatweer Co. for Educational Services, 2010).

The Tatweer educational price tag is similar to Vision 2030's huge investment in the Kingdom of Saudi Arabia. The researcher conducted a thorough investigation of the integration of the new policy initiatives in the Kingdom's higher educational institution that follow the new Tatweer-approved educational institutions. The initiative requires and mandates a professional staff development that would follow strict guidelines of the Tatweer initiatives for essential adherence to successful new educational programs in the Kingdom of Saudi Arabia (Roessingh, 2014).

The new policies would also require an adherence to an integration of the Saudi Arabian educational institutions under the realm of Tatweer that factors in reducing gender gaps in educational attainment, developed and structured higher educational policies, and the requirement of personnel to seek a continuum of trainings and professional advancement (Chen, 2008; Haydn & Barton, 2008; Wang, 2014).

Almaghlouth (2008) and Oyaid (2009) observed that the current Saudi higher education lacks a comprehensive understanding of the Tatweer initiatives and the applicability of the new policies and mandates. Almaghlouth (2008) examined the perception of the Saudi professional staff members towards the Tatweer initiatives and the implications it carries towards the enhancement of the teaching community. Almaghlouth also stated that the Kingdom's higher educational community lacks the necessary tools and techniques to fully comprehend the new teaching mandates and the usage of the newly implemented technological advancements.

Oyaid (2009) also stated that the current teaching professionals in the Kingdom also face difficulties and challenges on adhering to a singular mandate through the usage of modernized educational articulations. Oyaid recommended a thorough investigation of the currently expressed challenges by professionals and the required implacability of the Tatweer mandates in their educational institutions.

Cooper (2006) tackled the mandates of the Tatweer initiatives and the apparent challenges for the implementation within the Kingdom's higher educational institutions due to a wide gap that exists in digital technology education and usage between males and females in the Saudi higher education. Cooper found that the technology-based gap in gender attainment in the Kingdom of Saudi Arabia is much wider than the Western world due to systematic lack of adequate training rather than accelerated high tech integrations.

The Tatweer initiatives and the Vision 2030 challenges are apparent in Ezza's (2014) study. The research found that in the Kingdom's higher educational institutions the advancement of technology is adequately furnished to male students rather than female students. Consequently, it is important that female students be empowered to maintain adequate access to new technological tools and techniques to advance their educational attainments. Related to the aforementioned issues regarding the implement-ability of the Tatweer and Vision 2030 initiatives, the researcher examined thoroughly the technological advancement gaps that exist in the KSA higher education institutions through the prism of gender, socioeconomic status, and geographic location.

Purpose of the Study

This research study aimed to explore the challenges and accomplishments of the Tatweer reforms and the Vision 2030 in the Kingdom of Saudi Arabia higher educational system in the area of technology advancement. Specifically, the research study examined the current experiences of higher educational students and professional personnel in the Kingdom who view the transformational initiatives in higher education as an opportunity for the Saudi society to realize the attainment for all students irrespective of gender, socio economic status or regional affiliations and maintain a fair distribution of the allocated resources to the betterment of all Saudi students in higher education.

Significance of the Study

The practical significance of this study lies in its ability to explore avenues to improve the Kingdom's higher educational institutions through the prism of the Tatweer reform initiatives and the Vision 2030 educational development policies and mandates in the Kingdom of Saudi Arabia. The researcher managed to successfully examine the data garnered to articulate the findings and draft recommendations based on the findings to assist policy makers, higher educational professional personnel and administrators, and members of the Saudi society to meet the requirements of the transformational initiatives launched in the Kingdom's higher education in the 21st century.

The research managed to provide a comprehensive study that will enable Tatweer Public Policy leaders to realize the importance of closing the gaps in higher education attainment and technological advancements based on gender, socioeconomic status and regional affiliations. These disparities will impede the Kingdom to remain competitive

with the developed world. This information was presented as a case to foster the Tatweer and Vision 2030 policies for higher educational reforms in the Kingdom.

Research Questions

The purpose of this quantitative research was to describe and guide the implications of the new decentralized educational policy initiatives in KSA known as Tatweer reforms of the Kingdom's higher educational policies and Vision 2030 mandates for transformational mandates. Specifically, the following research questions guided the study:

RQ1: To what extent does the current IT infrastructure at the campus meet the needs of the faculty?

RQ2: To what extent does the current IT infrastructure at the campus meet the needs of the students?

RQ3: How do faculty perceptions of the IT infrastructure vary based on geographical location of the university, gender, area of teaching, and socioeconomic status?

RQ4: How do student perceptions of the IT infrastructure vary based on geographical location of the university, gender, major, and socioeconomic status?

CHAPTER II

LITERATURE REVIEW

This chapter provides a review of the recent literature related to Tatweer and Vision 2030 initiatives. The chapter starts with a synopsis of the current higher education trends and values in the Kingdom of Saudi Arabia. The chapter progresses to provide a detailed review of the Vision 2030 and the Tatweer initiatives along the lines of the higher education policies, concepts and understandings of the new guidelines that will transform educational systems in the Kingdom within the new realms of global educational competitiveness.

Chapter II also covers research-related topics on the transformational initiatives within the context of transformability, technological advancement and information technology adherence, social, cultural and gender accessibility, and affordability. These topics are outlined in the policies of the Tatweer initiatives in the Kingdom along with information on closing the gap of the existing regional affiliation of higher education.

Tatweer Initiatives and the 2030 Vision for Higher Education

This study explored the new Kingdom of Saudi Arabia's initiative to develop and uphold its higher educational institutions by implementing the Tatweer initiatives within the realms of the Vision 2030. It is also notable that the higher educational system in the Kingdom of Saudi Arabia experienced and developed to its current maturity through

many generational progressions solely adapted and implemented by the Supreme Council on Higher Education under the auspices of the Kingdom's Ministry of Education.

Vision 2030 was initiated by the government of Saudi Arabia in early 2016 as a method of modernizing the Kingdom's educational system to cope with the global educational transformations and enable the Kingdom to hold its competitive edge in the global village. Vision 2030 and the Tatweer initiatives have allowed the Kingdom to adapt the higher educational systems by focusing on eight separately linked strategic goals and plans to bring the Kingdom's higher education to the realm of modernized and transformed educational systems and policies.

Vision 2030

As a developing nation, the Kingdom of Saudi Arabia aims at increasing its global effectiveness by positioning itself through diversifying its economy well beyond the historical dependence on oil. The Kingdom managed to launch a systematic draft for its futuristic aspirations by minimizing the reliance on oil through measurable Economic Complexity Index (ECI) indicators for National Industrial Development Program that was initiated in 2017, known as Vision 2030's realization programs (Ministry of Education, 2016).

The Kingdom's utilization of the ECI to evaluate its National Industrial Development Programs will enable the nation to select practical and effective indicators that will ultimately impact the entire Kingdom's local product and service improvement decisions and will position the Kingdom in the route to successful and maintainable

diversification (Kaplan & Norton, 1992). Kaplan and Norton stated that nations who elect to successfully select effective indicators would gain the most effective outcomes.

Vision 2030 aims at maximizing the Kingdom's economic throughput by exploring diversified national strategic objectives and plans by exploring means and ways to make the Kingdom's budgetary decisions less dependent on oil and expand the participation of educated women in the workforce. The Kingdom of Saudi Arabia has a pool of college and university educated women that amounts to 50% of the Kingdom's workforce (Ministry of Education, 2015).

Higher Educational Structures in the Kingdom of Saudi Arabia

The Kingdom of Saudi Arabia holds significant wealth, political and geopolitical power and presence in the Arabian Peninsula. The nation of the Kingdom of Saudi Arabia is regionally divided into 13 separate provinces under the umbrella of the Royal family who maintains most forms of administrative duties, include higher education (Central Department of Statistics and Information, 2010). A higher education council leads in maintaining and overseeing educational policies in the Kingdom. The Kingdom of Saudi Arabia's Ministry of Education was inaugurated in 1952 when it was given the responsibility for the establishment and administration of higher education(Alqahtani, 2012) .

The Kingdom signed a Royal decree in January 2015 that permitted the merger of the Ministry of Education and the Council of Higher Education (Ministry of Education, 2015). The new merger between the two educational organizations and entities provided the government more power to control, maintain and initiate new policies as projects for

educational development started to gain ground in the Kingdom (Ministry of Education, 2014). King Abdullah bin Abdul-Aziz's Tatweer Project for the advancement of higher education took a step forward towards realizing the dream for the Kingdom's higher education to cope with global competitiveness.

Historical Foundations for Saudi Arabia's Educational Policies

Historically, in late 1969 the Kingdom of Saudi Arabia's Council of Ministries initiated and mandated a new policy documenting all aspects of educational practices and the vision of the Kingdom under Resolution No. 779. Many scholars viewed the Resolution No. 779 to be the primary foundation for the Saudi educational policies and practices. The new resolution aspired to view the Kingdom's educational systems from the prism of an Islamic theology that aimed at presenting the Kingdom with the ever-needed edge in scientific and technological advancement in an alignment with the Saudi's strategic policies for redevelopment of its entire infrastructure in the helm of the oil boom (United Nations Educational, Scientific and Cultural Organization [UNESCO], 2011).

The goals of the educational policy in the Kingdom were for the state to sponsor and provide all needed resources to maintain the rights of its citizens to free educational opportunities (Ministry of Education, 2008). UNESCO (2011) stated that role of the Supreme Committee for Educational Policies was to maintain a sole responsibility to draft educational strategic plans, oversee and manage all facets of the national educational policies under the following objectives:

1. The unwavering believes and adherence that all educational practices revolve around the core value of believing in Allah and that Islam is a unifying religion and that Mohammed (peace be upon him) is the Prophet of GOD;
2. The nation adheres to a strong conviction that all must view and conceive the vast life in the universe from the sole viewpoint of the Islamic theology and traditions;
3. The Kingdom of Saudi Arabia encourages and empowers its citizens to act according to the Islamic faith and reflect upon the faith to seek knowledge;
4. The Kingdom of Saudi Arabia would act based on the Islamic faith and theology to provide all necessities for its citizens to seek knowledge;
5. The Kingdom of Saudi Arabia also affirmed in its educational policies and guidelines for gender equality;
6. The Kingdom also stressed the importance to view education as a necessary tool to utilize in the overall statewide redevelopment plans and strategies and finally;
7. The Kingdom adheres to Arabic language to remain the official language of the State.
8. The King Abdullah Bin Abdul-Aziz Public Education Development Project.

The higher education policy initiative known as Tatweer is considered to be one of the most important educational strategies and policy-impacting initiatives drafted and signed by the late King Abdullah ibn Abdul-Aziz Al-Saud in the mid of 2007 that aimed

at transforming all aspects of the Kingdom's higher educational practices (Meemar, 2014).

The initiative was initially drafted to benefit the Kingdom's educational systems from various global educational advancements, techniques and practices with the main goal of maintaining a global edge in higher education that would in turn advance the Kingdom's Vision 2030 for global economic competitiveness. The Kingdom aimed at impacting its oil rich economy to explore alternate resources to gain an edge through adherence to stronger educational policies by implementing globally proven educational systems to advance the Kingdom to become a magnate and global economic super house.

The core value of the Tatweer policy initiative is to be viewed as an added value to the Kingdom's educational policy implementations through an effective adherence to knowledge-based society and education that would incorporate the following five major educational development programs:

1. Maintain a flow of professional educational development schematics;
2. Maintain an improved scheme of curriculum and instructions;
3. Maintain a constant and well improved and advanced milieu for educational facilities;
4. Maintain the usage of technology advancement to the betterment of all Saudi students and educational institutions; and
5. Maintain an advanced and globally competitive extracurricular mechanisms under the auspices of the student's affairs departments. (Tatweer, 2016)

The core philosophical advantage of the Tatweer policy initiative was to systematically forecast and anticipate project outcome in lieu of maintaining a unified educational system characterized by reformed, student centered and well-development institutions (Alyami, 2014). The policy was also aimed at improving student academic achievement to compete globally and closing the gender gap that the Kingdom of Saudi Arabia witnessed in delivering its non-even educational policies (Meemar, 2014).

The Tatweer Educational Policy Initiatives

The Kingdom of Saudi Arabia took the initiatives of the Tatweer project in a dynamic and nationally empowered scheme of super educational projects to move the Kingdom towards global competition in higher education (Chicago Forum, 2010). The core values of the Tatweer policy initiatives are to advance the Kingdom's general educational policies that will trickle towards advancing higher education by addressing four core elements:

1. Advancing the delivery of a quality oriented educational curricula from the prism of the recipient;
2. Social and cultural formations and conditions,
3. Systematically organize the selection processes of content, and
4. Improve institutional adherence to technological advancement through allocating highly qualified individuals to lead the project. (Tatweer Co. for Educational Services, 2010)

Tatweer Co. for Educational Services (2010) stressed the importance for the program to achieve its core value of improving quality Saudi scholars by transforming

higher educational systems through a global knowledge based educational contents. The project of the Tatweer and Vision 2030 initiatives were intended to carry the lead for institutionalizing the information and communication technologies components and resources in educational institutions by systematically creating new and advanced paradigms for professionals in the Kingdom of Saudi Arabia (Wiseman, Astiz, & Baker, 2013).

The Tatweer policy initiatives were intended in transforming the Saudi society to become digital natives in the Kingdom's higher educational institutions (Prensky, 2001). Based on the premise set by Prensky, the digitally oriented society ambitions were implied to create a society that is capable to manipulate and utilize the technology at a higher level through training and education. The main goals of the Tatweer initiative and the Vision 2030 ambitious transformation of the Saudi society will be plausible by implementing technology that must be carefully integrated with the overall objectives of preparing highly qualified individuals equipped for the new millennium educational and career skills (Partnership for 21st Century Skills, 2009).

Warschauer and Mathuchniak (2010) noted that the dissemination of the World Wide Web and computer technology would occur as an output of transforming industry within the information technology and the economy would subsequently benefit from such a transformation. Asharq Al-Awsat (2007) noted that for the Kingdom of Saudi Arabia to cope with such changes, the country must be willing to participate in a transformational revolution by focusing on high tech oriented students and institutional effectiveness based on technology.

Educators should focus, therefore, on educating students to use technology effectively and improve the necessary skills for using technology. The Kingdom of Saudi Arabia also adheres to the concept of Tatweer that aligns itself with 21st Century based skills as a major objective and core value (Tatweer, 2010). The Tatweer policy initiatives are inclined to systematically adapt to more dynamic learning opportunities alongside with the inquiry and project-based problem solving (Tatweer, 2010), and individualized student centered and oriented higher educational approaches.

Ghasemi and Hashemi (2011) stated that many developed nations in the world do lack an extensive background in the usage of information technology in their higher educational institutions. The Tatweer policy implications would provide the Kingdom of Saudi Arabia a greater opportunity in implementing the technology in all aspects of the society.

Tatweer Policy Initiatives and Gender Role

There are numerous research studies that examined gender-based differences in access to technological advancements in higher education (Cooper, 2006; Teo, 2014). Cooper (2006) stated that in the last twenty years, female students have been at a disadvantage in comparison to their male counterparts. Huffman, Whetten, and Huffman (2013) noted that gender based roles disparities are the sole source of the difference in technological readiness, exhibited as self-efficacy among higher education students. Kamal (2012) concluded that teachers' technological readiness and literacy to practice in higher education are systematically influenced by their gender and the gap is clearly

identifiable between male and female instructors and professionals. Some believe that this gap may be due to cultural reasoning and beliefs.

Information Technology Infrastructure

The higher education institutions of the Kingdom of Saudi Arabia had been asked to increase the use of new technological advancement on their campuses (Ministry of Communication and Information Technology, 2011). Prior to the implementation of the Tatweer initiatives, this mandate was characterized to be an information -technology oriented policy requirement in higher education (Wiseman et al., 2013).

The initial Saudi national higher education development initiatives mandated the various higher educational institutions to implement a greater role of technological advancement at their campuses between 1985 and 1990 and this initiative was under the auspices of the Fourth Plan for Educational Development (Ministry of Education, 2014). The institutions that implemented the plan were known and named as Educationally Developed institutions (Wiseman et al., 2013). The Kingdom of Saudi Arabia followed the lead of the Fourth Plan by subsequently mandating institutions to follow the Fourth Plan for technological advancement by institutionalizing the Fifth Plan for Educational Development (1990–1994) and the Sixth Plan for Educational Development (1995–2000), which witnessed similar successful implementation that provided the nation stronger footsteps towards global education. Wiseman et al. argued that the successfully implementation of the various plans was challenged by the adherence to the Kingdom's traditional culture of delivering education that resisted the implementation of high tech in

their educational institutions, thus opening the way for Tatweer and Vision 2030 initiatives to take leadership roles (Oyaid, 2009).

Conclusion

The literature review in Chapter II examined the current literature dealing with the Tatweer policy initiatives and Vision 2030. The scarce literature on the evaluation of the Tatweer initiatives demonstrates the urgent need to conduct a research on the topic aforementioned. The chapter began by examining the context of the research study and shed light on the limited literature available on the Kingdom of Saudi Arabia's policy initiatives of the Tatweer project and Vision 2030. The literature review indicated that only a few studies examined the information technology infrastructure, which is a critical component of the Tatweer initiatives. The literature review also indicated the need to explore the gender disparity that exists in the society and its implications on the Tatweer's initiatives to improve the information technology infrastructure in higher education.

CHAPTER III

THEORETICAL FRAMEWORK

In this chapter, the researcher outlines the conceptual framework that served as the basis for studying IT use and the opinions of faculty and students regarding the IT infrastructure at the nation's major universities. The researcher strongly believes that higher educational institutions must target the technological advancement in the Kingdom of Saudi Arabia as a core value in order for the mandates of the Vision 2030 and Tatweer educational ambitions to be realized.

The Technological Pedagogical Content Knowledge (TPCK)

The Technological Pedagogical Content Knowledge (TPCK) model developed by Mishra and Kohler (2006) served as the theoretical framework for the current study. The TPCK framework identifies how instructors' understanding of technology, pedagogy and content interact with each other to produce an effective educational technology and discipline-based teaching (Harris, Mishra, & Koehler, 2007).

The Technological Pedagogical Content Knowledge (TPCK) was initially developed by combining the technology area with Shulman's Model of Pedagogical Content Knowledge (Cox, 2008). The TPCK framework emphasizes the importance of relationships and interactions among content, pedagogy, and technology, and suggests these are essential for the development of an effective educator (Mishra & Kohler, 2006).

The TPCK framework has been employed to guide professional development in the area of educational technologies in different disciplines and at different levels of teaching: (a) university faculty and graduate students (Koehler & Mishra, 2005; Koehler, Mishra, & Yahya, 2007); (b) high school teachers and teacher candidates (Akkoç, Bingolbali, & Özmantar, 2008; Niess, 2005; Valtonen, Kukkonen, & Wulff, 2006); and (c) elementary school teachers (Hofer & Swan, 2008). TPCK is a framework that explains the teaching, diffusion, integration and efficiency of technology in educational institutions. The framework focuses on the relationships between technology on one hand and objectives, content, learning situations, and assessment on the other hand.

Objectives

It is very important to find an appropriate technology tool for the determined professional development objectives. If the desired objectives are to be reached then the most useful tool is needed to serve this purpose. According to the principles of program development, objectives should be identified in accordance with participants' needs and deficiencies in the specified field. For instance, a professional development program for new faculty might be different for that offered to seasoned faculty.

Content

The technology-content relationship has four main dimensions which makes it possible to assess whether technology is reflected into teaching at an adequate level. First, selected technologies should be relevant to the educational objectives of the educational program. Second, accessibility and availability of the chosen technology is also important. For example, shapes and scripts can be shown to students through

overhead projector transparencies. In this case the teacher has a chance to turn his face to the class when using the overhead projector. This is an advantage provided by overhead projectors. However, the overhead projector does not allow one to show moving images. In addition, a certain amount of darkness in the classroom is required. These are constrains associated with using this technology.

A third dimension has to do with the relationship between technology rarity and diversity. Programs dependent on specific and limited technology are likely to be outdated. Therefore, program developers must provide diversity in technological devices. By allowing the diversity of technological tools during program implementation, developers will ensure program flexibility, which is one of basic principles of program development.

The fourth dimension involves a consideration of whether or not using technology correctly as well as using correct technologies is included in the content. For example, static and simple web pages can be developed with Microsoft Word. However, more advanced software is needed to create a dynamic web page that queries a data base.

Teaching-Learning Situations

The teaching-learning situations and technology relationship can be examined from the perspective of the tool's intended use and its effect on learning. There are four levels that describe how technology is used for teaching:

Level 0: At this level, no technology is used.

Level 1 (Replacement): At this level, the instructor uses technology only to change the media. Moving the content that can be written on the blackboard into

PowerPoint presentations and projecting them on a screen so that students can read and write them is an example for this level. There is no change in participants' learning routines at this level of technology use.

Level 2 (Amplification): The use of technology at this level contributes to the effectiveness of the learning process Performing a calculation quickly and correctly with a calculator or a computer can be given as an example of technology use at this level.

Level 3 (Transformation): At this level, there are changes in learning and teaching routines and activities that lead students to better understand the content taught. Technological tools enable the teacher to demonstrate the relationship between concepts. For example, using Graphical Analysis software to teach different meanings of the derivative and the relationship between these meanings requires use of technology at this level (Ozmantar , Akkoc, Bingolbali, Demir, & Ergene, 2010).

Assessment

The use of technology for assessment and evaluation can also be described using a scale with four levels. The four levels adopted from Hughes (2005) as appropriate for assessment and evaluation are as follows:

Level 0: No technology is used for assessment;

Level 1: Technology is used only to change the media for conducting assessment. For example, at this level the instructor asks questions in written form and demands the answers in the electronic form. This is the lowest level use of technology for assessment.

Level 2: At this level assessment is done faster and more efficiently using technological tools and students are given feedback more quickly. Using computer-aided

tests or questionnaires in an example. Technology use at this level does not bring a different dimension or application to the evaluation process, but rather accelerates routine operations.

Level 3: At this level, technology can help instructors change assessment routines and accomplish more effective assessments. For instance, when video recordings of the classes are posted online, other participants and the course teacher get the opportunity to do a sound online evaluation by watching the videos.

The TCPK framework is shown in Figure 1.

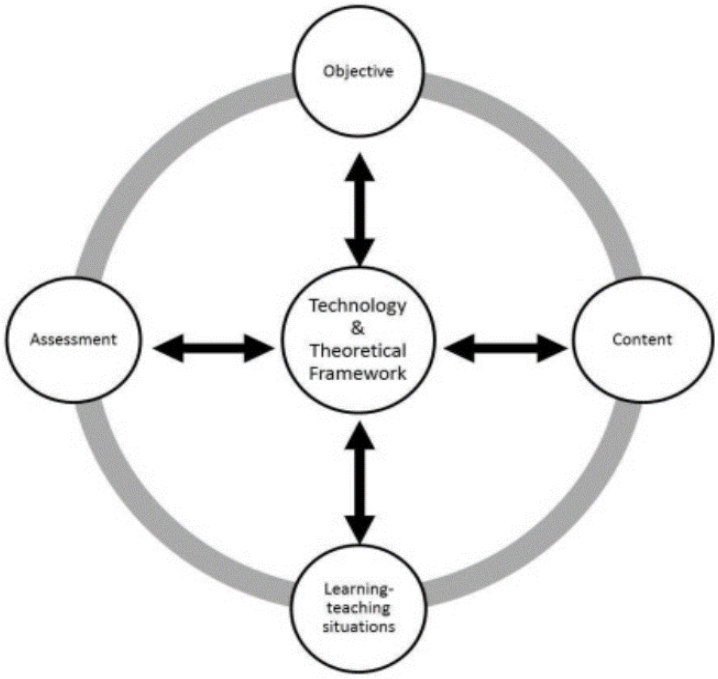

Figure 1. The TCPK framework.

Figure 1 illustrates the importance of carefully drafting the technology integration processes into a program's development. The integration process identifies the objectives for the integration necessities, thoroughly analyzes the current and futuristic content of the technological integration processes along with the functional responsibilities for

teaching and researching in the institution, and finally maintains the value address assessment procedures utilized in this research.

The policy makers who strive hard at implementing the new mandates of Vision 2030 and the Tatweer higher educational policies were at the core of this project. The Vision 2030 mandates for the transformation of the Saudi society through the implementation of technological implementation that would foster the societal transactional development to reach to its goals through a carefully drafted road maps for introducing net technology in the educational processes.

CHAPTER IV

METHODOLOGY

This chapter discusses the methodology that was employed by the researcher to examine faculty and student perceptions of the in the information technology infrastructure at their university. The chapter starts by presenting the research design and continues with a discussion of the research setting, participants, and instrumentation. The data analysis plan and data collection procedures that guided the study are included at the end of the chapter.

Research Design

This research was an ex-post facto cross-sectional study using a quantitative research methodology. Two surveys were administered through Survey Monkey to assess students and faculty opinion so of the IT infrastructure and their use of technology at five universities located in the Kingdom of Saudi Arabia.

The researcher examined four research questions by incorporating the following variables (see Table 1).

Table 1

Dependent and Independent Variables Examined

Research Question	Dependent Variable (DV)	Independent Variable (IV)
RQ1	Faculty Satisfaction with University IT Infrastructure	NA
RQ2	Student Satisfaction with University IT Infrastructure	NA
RQ3	Faculty Satisfaction with university IT Infrastructure	Gender, SES, Geographic location, teaching discipline
RQ4	Student Satisfaction with university IT Infrastructure	Gender, SES, Geographic location, major

Faculty Satisfaction with university IT Infrastrucure was defined as the extent to which faculty members are satisfied with the following components of the IT resources within their institutions:

1. Technology-enabled learning and working spaces provided
2. Technology-enhaced connections and communication resources
3. Technology support services available
4. Classroom technologies

Student Satisfaction with the university IT Infrastructure was defined as the extent to which students (undergraduate and graduate) are satisfied with the following components of the IT infrastructure at their respective institutions:

1. Support of activities performed on mobile devices (e.g., smartphone or tablet)
2. Wireless network on campus
3. Instructor usage of technology in the classroom

Three independent variables were examined in relation to student and faculty opionons of the IT Infrasstructure: gender, socioecoenomic status (SES), and campus location. Gender was coded as dichotomous variable, taking the value 1 for Male and 2 for Females. SES was measured as monthly familiy income using an ordinal scale with the following vaulues: (a) Low ($534 – $1,333 U.S. dollars); (b) Middle ($1,334 – $2,667 U.S. dollars); and (c) High (More than $2,667 U.S. dollars) per month.

Campus location included the following values:

1. Northern KSA (University 1)
2. Eastern KSA (University 2)
3. Western KSA (University 3)
4. Central KSA (University 4)
5. Capital of Riyadh (University 5)

Since the majority of the respondents were located in Riyadh, a new variable was recoded with two values: 1- Riyadh, and 2 - Outside Riyadh. Lastly, the major (for students) or area of tecahing (for faculty) was coded as 1 for science, technology, engineering, and mathematics (STEM) majors and 9 for non-STEM majors. STEM majors included the following fields:

1. biological/life sciences;
2. computer and information sciences;
3. engineering and architecture;
4. manufacturing, construction, repair, or transportation; and
5. physical sciences, including mathematical sciences

Non-STEM majors included the following fields:

1. agriculture and natural resources;
2. business, management, marketing;
3. communications/journalism;
4. education, including physical education;
5. fine and performing arts;
6. health sciences, including professional programs;
7. humanities;
8. liberal arts/general studies;
9. public administration, legal, social, and protective services;
10. social sciences;
11. other major not described above; and
12. undecided

Research Setting

The research study was conducted by garnering opinion data via Survey Monkey from the five Saudi Arabian universities:

1. University 1 (Public) is located in the Northern borders of the Kingdom with an estimated of 17, 000 students and 600 faculty members. The university has separate sections for male and female students.
2. University 2 (Public) has separate sections for male and female students and is located in the Eastern part of the Kingdom. The total student body is estimated to be 6.040 with 1,062 faculty members.

3. University 3 (Private) is a co-ed institution located in the Western part of the Kingdom with an estimated of 901 students and 133 faculty members.
4. University 4 (Public) is located in capital city of Riyadh with an estimated student population of 31,630 and 4,970 faculty members. The university has separate sections for male and female students.
5. University 5 (Private) is located in the capital city of Riyadh. The university is particularly geared towards female students and has a population of 60,000 students and an estimated 5,000 faculty members.

Participants

Convenience samples were used for both surveys. Participants in the student survey included 179 students at five major universities in the Kingdom of Saudi Arabia. About 80% of the respondents were undergraduate students and 20% were graduate students. About half of the respondents (87) did not disclose their university affiliations. For the other half of the respondents (82) that indicated their university, the large majority were located in the capital city: 32 (at University 4 and University 5). The remaining students were clustered mostly at University 1 (31 respondents) and University 2 (10 respondents).

Participants in the faculty survey included 129 faculty employed at the same universities where the student sample was drawn from. Approximately half of the respondents did not disclose their place of employment. Of those who indicated their employer, the majority were teaching in the capital city, at University 4 and University 5. Of the remaining respondents, the majority were employed at University 1.

Instrumentation

To study the students' opinions of the IT infrastructure at their campus, the researcher used an abbreviated version of the EDUCAUSE Center for Analysis and Research (ECAR) survey of undergraduate students and information technology. For 15 years, the EDUCAUSE has conducted research on information technology (IT) and higher education's most important end users, undergraduate students. With survey responses from a broad sample of 130 U.S. and international institutions, and from more than 64,000 students, the ECAR survey is one of the higher education IT industry's largest and longest-running explorations of students' technology experiences, behaviors, and preferences. For the 2018 report, 64,536 students from 130 institutions in 9 countries and 36 states in the United States participated in the ECAR survey.

The researcher translated the ECAR Student Survey in Arabic before sending it to the five universities. In the abbreviated survey, the researcher included the following sections for the ECAR Student Survey:

1. Mobile device access and use
2. Campus Wi-Fi experiences
3. Learning management system (LMS) use and satisfaction
4. Student learning environment preferences, and
5. Experiences with instructors and technology
6. Student Demographics

The second instrument was adapted the Faculty Technology Survey developed by the EDUCAUSE Center for Analysis and Research (ECAR) and translated into Arabic.

In order to meet the instructional technology and research computing demands of faculty, it is essential to understand how faculty relates to and use educational technologies, and what they think about their IT services. The ECAR Faculty Technology Survey was conducted three times and in its third edition, 13,451 respondents from 157 institutions in 7 countries (including the United States) and 37 states in the United States participated in the research.

The researcher included the following sections from the ECAR Faculty Technology Survey:

1. technology- enabled learning/working spaces
2. technology- enhanced connection and communication resources
3. technology support services
4. classroom technologies
5. demographics

Data Analysis

Data analysis for this research was conducted using the Statistical Package for the Social Sciences (SPSS) version 24. The researcher conducted descriptive analysis (percentage of satisfied and very satisfied) for the first two research questions and a series of independent sample t-tests and Pearson correlation coefficients for the last two research questions. Table 2 shows the data analysis methods for each of the four research questions.

Table 2

Data Analysis Methods

Research Questions	Dependent Variable	Independent Variables	Data Analysis
RQ1	Faculty Satisfaction with University IT Infrastructure	N/A	Descriptive Analysis (%s)
RQ2	Student Satisfaction with University IT Infrastructure	N/A	Descriptive Analysis (%s)
RQ3	Faculty Satisfaction with the IT Infrastructure	Gender	T test
		SES	Pearson's Correlation
		Location	T test
		Teaching Discipline	T test
RQ4	Student Satisfaction with the IT Infrastructure	Gender	T test
		SES	Pearson's Correlation
		Location	T test
		Major	T test

Data Collection Procedures

First, the researcher obtained approval from the leadership at the sampled universities to distribute the survey to students and faculty. In addition, approval for conducting the study was obtained from the Saudi Arabian Cultural Mission (SACM).

Second, participants in this research study (both faculty and students) received a thorough explanation of the purpose of the study, the researcher's responsibility and role, researcher's personal contact information, any plausible harm or risks, the voluntary

nature of the study, and the process to withdraw from the research study at any time. The informed consent is a fundamental, ethical and moral requirement of the principles governing scientific studies with human subjects (Houghton, Casey, Shaw, & Murphy, 2010). Obtaining signed informed consent from all selected participants ensured that the rights of the participants would be protected and decreased the probability of misleading results (Franklin, Rowland, Fox, & Nicolson, 2012).

The surveys were translated in Arabic and administered via Survey Monkey. The surveys were open for data collection for a period of three weeks. Both students and faculty had an opportunity to indicate that they do or do not want to participate in the study in the first page of the survey, thus ensuring formal consent.

Summary

This chapter discussed the research methodology employed by the researcher to answer the four research questions. The researcher employed a cross-section research design utilizing two surveys adapted from the ECAR faculty and student surveys. A convenience sampling technique was used to gather the opinions of faculty and students at five major universities in the Kingdom of Saudi Arabia.

CHAPTER V

FINDINGS

The purpose of this chapter was to present the findings related to the research questions examined in the study. Two datasets were collected by conducting surveys with students and faculty from five universities in the Kingdom of Saudi Arabia. Four research questions were investigated:

RQ1: To what extent does the current IT infrastructure at the campus meet the needs of the faculty?

RQ2: To what extent does the current IT infrastructure at the campus meet the needs of the students?

RQ3: How do faculty perceptions of the IT infrastructure vary based on geographical location of the university, gender, area of teaching, and socioeconomic status?

RQ4: How do student perceptions of the IT infrastructure vary based on geographical location of the university, gender, major, and socio-economic status?

Description of Samples

The researcher managed to access a wide range of current Saudi Arabian university students and faculty members by utilizing a web-based technology available

through Survey Monkey. Both samples were convenience samples. The samples consisted a total of 129 faculty participants and 179 students in various academic disciplines.

Faculty Sample

The researcher garnered a total of 129 responses from the faculty teaching at five universities located in different geographic areas so as to reflect the totality of the general faculty members in the KSA. The faculty sample characteristics were examined based on age range, gender and income (see Table 3).

Table 3

Characteristics of the Faculty Sample (N=129)

Sample Characteristic	%	N
Age		
30 or younger	20.6%	22
31-40	30.8%	33
41-50	29.0%	31
51-60	11.2%	12
Over 60	8.4%	9
Gender		
Male	33.0%	35
Female	66.0%	70
Not Identified	0.9%	1

(continued)

Sample Characteristic	%	N
Family Monthly Income		
Low ($533 to $1,333 U.S. dollars)	7.4%	8
Middle ($1,334 to $2,667 U.S. dollars)	18.5%	20
High (more than $2,667 U.S. dollars)	74.1%	80

Note: Not all 129 faculty respondents answered the demographic questions.

Saudi Arabia is a conservative society that upholds to the traditional role of women as family leaders, with minimal roles in public arena or the workplace. The faculty sample did not mirror this imbalance in the general society; approximately 66% of the total faculty members surveyed were women and only 34% of the faculty members were men. This is because a large majority of the faculty who completed the survey were female students from University 5 in the Capital of Riyadh.

The higher percentage of women in faculty positions did reflect a positive trend toward closing the achievement gap based on gender that has characterized the Saudi society. The goal of the current Saudi administration, based on the policies of the 2030 Vision Achievement through the Tatweer policies and mandates in higher education, is to increase women's representation in higher education.

The distribution of the faculty sample by age also revealed that about 51% of the Saudi faculty members are younger than 40. Traditionally, the Saudi society has been deeply rooted in traditional roles of the elderly with minimal opportunities for the younger generations who found little to nothing roles in the development of the nation. Since the inception of the mandates and policy changes of the 2030 Vision and the

Tatweer of Saudi Arabian higher educational institutions, the younger generation has been enjoying unlimited opportunities and venues to participate in the national discourse.

The demographic profile of the faculty sample suggests that the composition of the Saudi higher education faculty members is changing the traditional roles based on age and gender. The data show that women and younger faculty members are taking the lead roles in revolutionizing the Saudi higher education institutions, thus realizing the goals of the Vision 2030 and the Tatweer policies for higher education.

The distribution by income also showed that the discovery of oil in the Kingdom in the late 1960s and early 1970s provided the citizens an opportunity to enjoy higher income than many Middle Eastern nations. The survey revealed that faculty members in the sample enjoy higher monthly income in comparison to the national per capita.

If one considers that the majority of the current Saudi faculty members in the sample are women, younger, and earning incomes that are higher than the national average, then the Vision 2030 and the Tatweer policy are on track to reach their ambitious mandates. The data indicate a positive upward trend for women faculty members. The struggle to maintain the current positive trend has to continue if the Kingdom of Saudi Arabia wants to close the achievement gaps based on age, gender and income that have characterized the Saudi society for centuries.

Student Sample

The researcher also garnered student opinions through a web-based survey that was conducted with Saudi Arabian students in higher education. The researcher received a total of 179 responses. The researcher viewed and concluded this response rate from

the student population to be considered a limitation. The researcher concluded the response rate from the total student population to be the hindrance of accessing a wide range of higher educational institutions student body due to the absence of articulated understanding of Saudi Arabian higher educational administrators in providing contact information of their student body for the researcher to contact and garner all necessary interview response rates.

Table 4 summarizes the sample distribution by level, gender, and income levels. A large majority of the respondents were undergraduates (84%), females (69%), coming from high income families (74%).

Table 4

Characteristics of the Student Sample in Saudi Arabian Universities (N=179)

Sample Characteristic	%	N
Level		
Undergrad	83.5%	76
Graduate	23.1%	21
Gender		
Male	30.9%	30
Female	69.1%	67
Income		
Low ($533 - $1,333 U.S. dollars) per month	7.4%	8
Middle ($1,334 to $2,667 U.S. dollars) per month	18.5%	20
High (more than $2,667 U.S. dollars) per month	74.1%	80

Note: Not all 179 student respondents answered the demographic questions.

RQ1 Findings

RQ1: To what extent does the current IT infrastructure at the campus meet the needs of the faculty?

In order to answer the first research question, the researcher employed a faculty survey that was administered online at five universities across KSA. A total of 129 faculty responded to the web survey. The survey was divided into the following categories:

1. Technology-enabled learning and working spaces provided;
2. Technology-enhanced connections and communication resources;
3. Technology-supported services to staff, faculty and students; and
4. Classroom-teaching technologies and pedagogies

The following results discuss the extent to which faculty are satisfied with the technology support in each of the four categories. Table 5 presents the results of faculty satisfaction with technology-enabled learning and working spaces. Overall, faculty were generally satisfied with the technology-enabled learning and work spaces offered by their universities. In most areas, more than half of the respondents chose ratings of *good* or *excellent*. However, respondents were least satisfied with access to institutional resources while traveling, as only 39% rated this item as good or excellent.

Table 5

Descriptive Statistics for Technology-Enabled Learning and Working Spaces

Faculty Satisfaction with:	Service not offered	Haven't used in the past year	% Ratings Good or Excellent among Users	N
Classroom-based technology resources (e.g., computers, projection systems, lecture-capture systems, SMART boards, etc.)	3.9%	0.0%	78.2%	129
Laboratory or research-based technology resources (e.g., computers, research equipment, etc.)	9.4%	9.4%	65.4%	128
Online collaborative spaces in which your students or colleagues can work synchronously or asynchronously on projects	10.1%	3.1%	75.0%	129
Physical collaborative spaces (e.g., computer labs, testing centers, research labs, active learning classrooms, etc.)	9.6%	12.0%	52.0%	125
Access to institutional resources while working from home	13.6%	4.8%	56.9%	125
Access to institutional resources while traveling and/or living in other states or countries	16.1%	9.7%	39.1%	124
Ability to get my work done while working from home	8.0%	6.4%	74.8%	125
Ability to get my work done while traveling and/or living in other states or countries	8.7%	11.0%	60.8%	127

When respondents were asked to indicate their satisfaction with the technology-enabled connections and communication resources at their universities, most were pleased with the services offered. Yet, about 25% have not used video conferencing technologies; of those who used such technologies, only 57% rated them as good or excellent. In addition, approximately 43% of the respondents have not accessed remotely software applications; of those who did have remote access, only half were satisfied (see Table 6).

Table 6

Descriptive Statistics for Technology-Enabled Connections and Communication Resources

Descriptive Statistics	Service not offered	Haven't used in the past year	% Good or Excellent	N
Reliable access to Wi-Fi networks throughout campus	7.4%	4.1%	81.5%	122
Communication technologies (e.g., e-mail, instant messaging, social media, etc.)	1.6%	0.8%	88.2%	122
Videoconferencing technologies (e.g., Skype, Google Hangouts, Adobe Connect, other web-based conference services)	9.8%	14.6%	57.0%	123
Online or virtual technologies (e.g., network or cloud-based file storage system, web portals, etc.)	7.3%	9.7%	63.1%	124

(continued)

Descriptive Statistics	Service not offered	Haven't used in the past year	% Good or Excellent	N
Remote access (as opposed to locally install) to commercial software applications (e.g., MATLAB, GIS applications, statistical software, graphics software, textual or image analysis programs, etc.)	20.5%	23.0%	49.3%	122

Faculty members were also generally satisfied with the technology support services offered at their campus (see Table 7). More than 60% rated technology support and professional development on use of technology in teaching as *good* or *excellent*. However, about a quarter have not received support for making courses accessible to students with disabilities; of those who did have such support, only half were satisfied with the support. In addition, 25% have not used or did not have support for specialized teaching software. Of the users, only 44% were satisfied with the support received.

Table 7

Descriptive Statistics for Technology Support Services

Descriptive Statistics	Service not offered	Haven't used in the past year	% Good or Excellent	N
Technology support (e.g., desktop support, classroom technology support, course media production support, etc.)	6.8%	6.0%	63.7%	117

(continued)

Descriptive Statistics	Service not offered	Haven't used in the past year	% Good or Excellent	N
Professional development around the integrated use of technology in your teaching, whether face-to-face or online (e.g., technology training opportunities, incentives, and professional advancement)	6.0%	8.6%	65.0%	117
Support for making courses accessible to students with disabilities	7.8%	15.5%	50.6%	116
Professional development and training opportunities around the integrated use of technology in your research	6.0%	6.0%	54.9%	116
Individualized consultations for using technology in teaching (e.g., course design)	6.9%	8.6%	58.2%	116
Specialized teaching software	10.6%	15.0%	44.0%	113

About two-thirds of the faculty were satisfied with the availability of classrooms with multimedia equipment (see Table 8). More than half of the faculty were satisfied with the reliability of equipment, the general use of instructor stations in the classrooms, the software installed on the instructor-station computers, and the computer projectors. However, less than half of the faculty gave favorable ratings to wireless access and audience response systems (clickers).

Table 8

Descriptive Statistics for Satisfaction with Classroom Technologies

	Satisfied	N/A	N
Availability of classrooms with multimedia equipment	66.3%	7.1%	112
Reliability of equipment available	63.8%	6.3%	112
General ease of use of instructor stations	63.5%	7.1%	112
Computers in the instructor stations	59.8%	8.1%	111
Software on the instructor-station computers	59.6%	10.8%	111
Computer projection	53.6%	11.8%	110
Audience response systems (clickers)	46.9%	14.3%	112
Wireless access	45.8%	14.3%	112

Overall, about 68% of the faculty were satisfied with the technology at their campus, rating their experience as excellent or good and 28% rated their overall experience as fair poor (see Table 9).

Table 9

Overall Experience with Technology at Current Institution

	N	%
Poor	10.8%	12
Fair	17.1%	19
Neutral	4.5%	5
Good	48.7%	54
Excellent	18.9%	21

In sum, the dataset on faculty satisfaction with the implementation of technology revealed positive views of the technological infrastructure available at the universities that participated in this study. The data showed that most of the faculty members graded the technological infrastructure within the acceptable range, with a majority of respondents grading the technology available on campus as being good or excellent.

The researcher understands that the strategic and policy implications of the Vision 2030 and the Tatweer mandates ought to reflect a stronger positioning in implementing technological advancements in the Saudi universities communities. The main auspice of the Vision 2030 is to introduce a higher rate of technological application the Saudi higher educational institutions and through the application the ambition is that the Saudi society would cope in a revolution to bring the country to the level of 1st World Nations by 2030.

The researcher concluded that the proportion of faculty ratings of good and excellent to the current technological application may need to be raised higher by spending more in technology, training and applicability and accessibility of technology throughout the Kingdom.

RQ2 Findings

RQ2: To what extent does the current IT infrastructure at the campus meet the needs of the students?

In order to answer the second research question, the researcher employed a web-based student survey and received responses from 179 students from five universities across the Kingdom. More than 80% of the respondents were undergraduate students. The survey is divided into the following categories:

1. Support of activities performed on a handheld mobile device (e.g., smartphone or tablet);
2. Experiences with wireless networks on campus;
3. The ability for instructor usage of technology in the classroom.

Table 10 captures the students' views of university support of applications for mobile devices. About 37% of the students said that they did not access library services via their mobile devices and 26% did not use mobile devices to register for classes. Approximately two-thirds of the student report that they have not used mobile devices to pay tuition or fees.

Table 10

University Support for Mobile Devices

	Service not offered/does not function on my mobile device	Haven't used service in the past year	% Good or Excellent	N
Accessing library resources	12.4%	24.9%	57.7%	177
Checking grades	10.7%	13.0%	52.6%	177
Accessing course content (e.g., syllabus, recorded lectures, supplemental learning materials, e-texts, podcasts, blogs)	5.6%	5.6%	64.8%	179
Using the learning management system (e.g., Blackboard, Moodle, Sakai, D2L Brightspace, Canvas)	5.0%	5.6%	71.9%	179

(continued)

	Service not offered/does not function on my mobile device	Haven't used service in the past year	% Good or Excellent	N
Registering for courses	10.6%	15.6%	66.7%	179
Reviewing transcript	14.0%	25.3%	50.9%	178
Making tuition/fee payments	11.8%	53.9%	50.8%	178
Accessing information about events, student activities, and clubs/ organizations	5.7%	6.2%	65.4%	177
Providing identification to access campus facilities or services	14.7%	16.4%	59.0%	177
Verifying/recording attendance for class or campus activities	10.7%	13.5%	63.0%	178
Using e-texts	6.2%	24.9%	55.7%	177
Communicating with instructors about class-related matters/outside class sessions	1.7%	6.2%	67.1%	178
Taking notes in class	10.2%	10.7%	60.7%	177
Answering questions posed in class to generate/tally automatic responses	10.2%	17.1%	56.3%	176
Participating in interactive class activities (e.g., group discussion, collaborative writing)	8.4%	12.4%	65.2%	178

(continued)

	Service not offered/does not function on my mobile device	Haven't used service in the past year	% Good or Excellent	N
Producing content (e.g., documents, spreadsheets, presentations, videos)	6.7%	5.1%	68.8%	178

Overall, more than half of the students who used their mobile devices for various functions were satisfied with the university support for mobile devices. The highest satisfaction ratings were obtained for using learning management systems (72%), registering for courses (67%) and communicating with instructors (67%). When asked about satisfaction with the wireless networks on campus, only 40% reported that the reliability of access to Wi-Fi in student housing was *good* or *excellent*. Only 31% were satisfied with the network performance and 28% were satisfied with the reliability of access to Wi-Fi in outdoor spaces. Satisfaction with the reliability of access to Wi-Fi was relatively low even in indoor spaces; 51% in campus libraries, 52% in classroom spaces, and 42% in other indoor spaces (see Table 11).

Table 11

Satisfaction with Wireless Networks on Campus

Satisfaction with:	Good or Excellent	N/A	N
Reliability of access to Wi-Fi in student housing/dormitories	39.7%	46.6%	146
Reliability of access to Wi-Fi in campus libraries	50.8%	10.3%	145

(continued)

Satisfaction with:	Good or Excellent	N/A	N
Reliability of access to Wi-Fi in classroom/ instructional spaces	51.9%	9.7%	145
Reliability of access to Wi-Fi in other indoor public spaces	42.0%	10.3%	146
Reliability of access to Wi-Fi in outdoor spaces	28.0%	9.0%	145
Ease of login to Wi-Fi network(s) provided by the institution	57.0%	11.7%	145
Network performance (e.g., high speed, no interruptions)	31.3%	7.6%	145

Note: About 47% of the respondents in the sample do not live in student housing.

About 35% of the students report that none or very few of their instructors use technology in face-to-face settings to engage them in the learning process. Likewise, 42% say that none or very few instructors encourage students to use their own technology devices during class to deepen learning (e.g., by searching online for related concepts, examples, or demonstrations). It is also important to note that a large percentage of the students are not encouraged by their instructors to use technology in the classroom. For instance, a large percentage of the respondents say that none or very few instructors have them use the tablet (44%), Smartphone (46%), and laptop (37%) as learning tools in the classroom. Table 12 summarizes the students' opinions regarding their instructors' use of technology in the classroom.

Table 12

Instructors' Use of Technology in the Classroom

	N/A or don't know	None	Very few	Some	Most	Almost all	All	N
…use technology adequately for course instruction	3.2%	8.7%	18.3%	22.2%	18.3%	20.6%	8.7%	126
…use technology in face-to-face settings to engage you in the learning process	12.0%	9.6%	24.0%	18.4%	15.2%	12.8%	8.0%	125
…use technology during class to make connections to the learning material or to enhance learning with additional materials (e.g., by providing audio or video examples/ demonstrations/simulations of learning concepts)	5.7%	19.4%	18.6%	17.7%	14.5%	15.3%	8.9%	124
…encourage you to use your own technology devices during class to deepen learning (e.g., by searching online for related concepts, examples, or demonstrations)	4.8%	22.2%	19.8%	22.2%	8.7%	12.7%	9.5%	126
…encourage you to use online collaboration toolsto communicate/ collaborate with the instructor or other students in or outside class	7.1%	15.1%	18.3%	23.0%	11.1%	12.7%	12.7%	126
...encourage you to use technology for creative or critical-thinking tasks	8.9%	16.9%	17.7%	18.6%	12.1%	13.7%	12.1%	124
...have you use your tablet as a learning tool in class	8.9%	21.0%	22.6%	16.1%	4.0%	11.3%	16.1%	124
...have you use your smartphone as a learning tool in class	4.8%	24.0%	22.4%	16.8%	10.4%	10.4%	11.2%	125
...have you use your laptop as a learning tool in class	5.6%	20.8%	16.0%	16.0%	11.2%	13.6%	16.8%	125

Students were also asked to identify resources and tools that instructors should use more in the classroom. The results summarized in Table 13 indicate that students would like their instructors to use more learning management systems, e-books, and lecture capture. They would also like their instructors to allow more use of mobile devices in the classroom.

Table 13

Resources/Tools that Students Would Like Their Instructors to Use More

	Don't know	(Less) 1	2	3	4	(More) 5	N
Learning management system (e.g., Blackboard, Moodle, Sakai, D2L Bright space, Canvas)	12.3%	21.7%	13.2%	17.9%	11.3%	23.6%	106
Online collaboration tools to communicate/ collaborate	23.6%	19.8%	18.9%	9.4%	11.3%	17.0%	106
E-portfolios	33.7%	23.1%	12.5%	10.6%	6.7%	13.5%	104
E-books or e-textbooks	22.6%	15.1%	16.0%	16.0%	7.6%	22.6%	106
Free, web-based content to supplement course-related materials (e.g., Open Courseware, Khan Academy, iTunes U, YouTube, etc.)	23.8%	27.6%	16.2%	11.4%	5.7%	15.2%	105
Simulations or educational games	30.2%	35.9%	9.4%	9.4%	7.6%	7.6%	106
Lecture capture (i.e., recording lectures for later use/review)	18.3%	31.7%	12.5%	10.6%	12.5%	14.4%	104
student laptops as learning tools for course-related activities	23.6%	20.8%	17.0%	9.4%	9.4%	19.8%	106
Student tablets as learning tools for course-related activities	18.9%	27.4%	15.1%	10.4%	6.6%	21.7%	106

(continued)

	Don't know	(Less) 1	2	3	4	(More) 5	N
Student Smartphones as learning tools for course-related activities	16.0%	32.1%	9.4%	13.2%	13.2%	16.0%	106
Social media as a teaching and learning tool	20.8%	29.3%	17.0%	10.4%	6.6%	16.0%	106
Software to create videos or multimedia resources as a learning tool for course-related activities	25.7%	33.3%	10.5%	9.5%	10.5%	10.5%	105
Early-alert systems designed to catch potential academic trouble as soon as possible	38.1%	31.4%	9.5%	5.7%	8.6%	6.7%	105
Search tools to find references or other information online for class work	20.0%	21.0%	19.1%	9.5%	11.4%	19.1%	105
Textbook Publisher electronic resources (e.g., quizzes, assignments, tutorials, homework, practice problems)	17.9%	17.9%	23.6%	15.1%	12.3%	13.2%	106
In-class polling tools (e.g., clickers, Poll Everywhere, SMS-based tools)	28.6%	28.6%	11.4%	14.3%	7.6%	9.5%	105

Lastly, the survey asked students to rate their overall experience with technology at the current institution. Approximately 71% considered that their experience was good or excellent. Only 23% of the students rated their experience as poor or fair (see Table 14).

Table 14

Overall Experience with Technology at Current Institution

	%	N
Poor	6.0%	6
Fair	17.0%	17

(continued)

	%	N
Neutral	6.0%	6
Good	46.0%	46
Excellent	25.0%	25
Don't Know	0.0%	0

The researcher concluded that student engagement with technology in the Kingdom of Saudi Arabia is lower when compared to the responses provided by the faculty members. The implementation, accessibility and affordability of technological advancements an Saudi campuses is a crucial component to the survivability of higher education, the successful implementation of the Tatweer mandates, and the nation's capacity to compete globally. The researcher is aware that Saudi Arabia has embarked the usage of technology in the last decade and this transformation would take few more years to fully reach its capacity.

RQ3 Findings

RQ3: How do faculty perceptions of the IT infrastructure vary based on geographical location of the university, gender, area of teaching, and socioeconomic status?

Differences by Gender

To compare satisfaction with the IT infrastructure between male and female faculty, the researcher used an independent samples t-test. Table 15 indicates that average satisfaction ratings are comparable between men (M = 3.69) and women (M = 3.47), with a slightly more favorable rating for men.

Table 15

Overall Technology Experience by Gender

Gender	N	Mean	Std. Deviation
Male	35	3.69	1.25
Female	70	3.47	1.21

Note: Overall Technology Experience was measured on a 5-point Likert Scale with the following values: 1 = Poor, 2 = Fair, 3 = Neutral, 4 = Good, 5 = Excellent

To determine whether there was a significant difference between male and female faculty, the researcher conducted an independent samples t-test. The results are summarized in Table 16 and indicate that satisfaction with the university technology infrastructure does not differ significantly between male and female faculty, $t(103) = .84$, $p = .40$.

Table 16

Results of Independent Samples T-test: Overall Technology Experience by Gender

		Levene's Test for Equality of Variances		t-test for Equality of Means		
		F	p	t	df	p
q6	Equal variances assumed	.005	.944	.844	103	.401
	Equal variances not assumed			.834	66.058	.407

Differences by Socioeconomic Status

In order to examine the relationship between satisfaction with the IT infrastructure and socioeconomic status, the researcher calculated the Pearson's

correlation coefficient. Satisfaction with the IT infrastructure was measured through one question that asks faculty to rate their overall satisfaction with the IT infrastructure, while socioeconomic status was measured by family income. Table 17 indicates that the correlation coefficient was not statistically significant, r (108) = -.03, p =.736. Therefore, satisfaction with the IT infrastructure does not vary with the faculty member's socioeconomic status.

Table 17

Correlation between Family Income and Overall Technology Experience

		q6	Income
q6	Pearson Correlation	1	-.033
	Sig. (2-tailed)		.736
	N	111	108
Income	Pearson Correlation	-.033	1

Differences by Geographical Location

The majority of the faculty respondents (74%) were concentrated in the universities located in the capital city of Riyadh (Universities 4 and 5). About 24% of the respondents came from universities located outside Riyadh. The descriptive statistics for satisfaction with the IT infrastructure show that faculty who teach at universities located in Riyadh were more satisfied with the technology infrastructure at their campus than faculty who teach outside Riyadh (see Table 18).

Table 18

Overall Technology Experience by University Location

	Location	N	Mean	Std. Deviation
q6	Riyadh	72	3.75	1.06
	Outside Riyadh	27	3.11	1.48

NOTE: Overall Technology Experience was measured on a 5-point Likert Scale with the following values: 1 = Poor, 2 = Fair, 3 = Neutral, 4 = Good, 5 = Excellent

In order to determine whether satisfaction with the IT infrastructure differed significantly between the two groups, the researcher conducted an independent samples t-test. The results are summarized in Table 19 and show that there was a significant difference between the two groups, $t(36)= 2.06$, $p < .05$. Specifically, faculty who teach at universities in Riyadh are significantly more satisfied with the technology infrastructure at their campus than faculty who teach outside the capital.

Table 19

T-test Results for Differences in Overall Technology Experience by University Location

		Levene's test of Equality of Variances		t test of equality of means		
		F	Sig.	t	df	Sig. (2-tailed)
q6	Equal variances assumed	14.978	.000	2.389	97	.019
	Equal variances not assumed			2.059	36.487	.047

Differences by Teaching Discipline

Teaching disciplines were grouped into two large categories: STEM and Non-STEM disciplines. Table 20 displays the average satisfaction ratings for the two groups of faculty, indicating that the two averages area comparable.

Table 20

Overall Technology Experience by Faculty Teaching Discipline

	Teaching Discipline	N	Mean	Std. Deviation
q6	STEM	38	3.58	1.15
	Non-STEM	73	3.42	1.34

Note: Overall Technology Experience was measured on a 5-point Likert Scale with the following values: 1 = Poor, 2 = Fair, 3 = Neutral, 4 = Good, 5 = Excellent

As with the other independent variables, an independent samples *t*-test was conducted to determine whether the two averages differ significantly. The test indicates that there was no significant difference between STEM and Non-STEM faculty in terms of the overall experience with technology on campus, $t(109) = .60$, $p = .549$ (see Table 21).

Table 21

T-test Results for Differences in Overall Technology Experience by Teaching Discipline

		Levene's test of Equality of Variances		t test of equality of means		
		F	Sig.	t	df	Sig. (2-tailed)
q6	Equal variances assumed	1.683	.197	.602	109	.549
	Equal variances not assumed			.631	85.678	.530

RQ4 Findings

RQ4: How do student perceptions of the IT infrastructure vary based on geographical location of the university, gender, major, and socioeconomic status?

Differences by Gender

As with the faculty survey, perceptions of the IT infrastructure were assessed using a survey question that asks respondents to rate their overall satisfaction with the IT infrastructure. Responses were captured on a 5-item Likert scale with answers ranging from 1 = poor to 5 = excellent. Table 22 shows that the average satisfaction ratings were comparable between male and female students (3.60 vs. 3.77).

Table 22

Student Overall Rating of Experience with Technology by Gender

Gender	N	Mean	Std. Deviation
Male	30	3.60	1.19
Female	65	3.77	1.18

NOTE: Overall Technology Experience was measured on a 5-point Likert Scale with the following values: 1 = Poor, 2 = Fair, 3 = Neutral, 4 = Good, 5 = Excellent

To verify whether the small difference between the two groups of student was statistically significant, the researcher employed an independent samples t-test. The results of the t-test are presented in Table 23 and show that the two means did not differ significantly, t(93)= .647, p = .519.

Table 23

Results of Independent Samples T-test: Student Overall Rating of Experience with Technology by Gender

		Levene's test of Equality of Variances		t test of equality of means		
		F	Sig.	t	df	Sig. (2-tailed)
q5	Equal variances assumed	.048	.827	-.647	93	.519
	Equal variances not assumed			-.645	56.101	.522

Differences by Socioeconomic Status

The relationship between satisfaction with the IT infrastructure and socioeconomic status was explored suing Pearson's correlation coefficient.

Socioeconomic status was measured using a proxy—family income. The relationship between the two variables was not statistically significant, $r(94)=.076$, $p = .468$ and is shown in Table 24.

Table 24

Correlation between Student Overall Technology Experience and Family Income

		Overall Teaching Experience	Income
Overall Teaching Experience	Pearson Correlation	1	.076
	Sig. (2-tailed)		.468
	N	100	94
Income	Pearson Correlation	.076	1
	Sig. (2-tailed)	.468	
	N	94	96

Differences by University Location

Since there were not enough respondents from the universities located in the Northern, Western, and Eastern regions, responses from universities located in these regions were collapsed into one group—outside Riyadh. Therefore, average satisfaction ratings were compared between two groups of students: students studying in Riyadh and students studying outside Riyadh. Table 25 summarizes the averages for the two groups and shows that the average rating for students in Riyadh was higher than the average rating for students studying outside Riyadh (4.10 vs. 3.29).

Table 25

Differences in Student Overall Teaching Experience by University Location

Gender	N	Mean	Std. Deviation
Riyadh	51	4.10	.88
Outside Riyadh	38	3.29	1.29

Note: Overall Technology Experience was measured on a 5-point Likert Scale with the following values: 1 = Poor, 2 = Fair, 3 = Neutral, 4 = Good, 5 = Excellent

An independent samples t-test was used to evaluate whether the average ratings differed significantly between the two groups. Table 26 lists the results of the test and shows that there was a statistically significant difference between the two averages, $t(61) = 3.33$, $p < .05$. Students studying at universities in the capital city were more satisfied with the IT infrastructure at their campus than the rest of the students.

Table 26

T-test Results: Student Overall Teaching Experience by University Location

		Levene's test of Equality of Variances		t test of equality of means		
		F	Sig.	t	df	Sig. (2-tailed)
q5	Equal variances assumed	16.754	.000	3.514	87	.001
	Equal variances not assumed			3.327	61.421	.001

Differences by Major

For the purpose of this analysis, student major was grouped into two categories: STEM and non-STEM. The average ratings for the overall experience with technology on

campus for STEM and non-STEM majors are summarized in Table 27. STEM majors had a slightly better experience with information technology on campus than the rest of the students.

Table 27

Differences in Student Overall Teaching Experience by University Location

Major	N	Mean	Std. Deviation
STEM	37	3.78	1.20
Non-STEM	63	3.60	1.20

Note: Overall Technology Experience was measured on a 5-point Likert Scale with the following values: 1 = Poor, 2 = Fair, 3 = Neutral, 4 = Good, 5 = Excellent

Table 28 lists the results of an independent samples t-test that examines whether the difference in on the overall technology experience between STEM and non-STEM majors is statistically significant. The results reveal that there is no statistically significant difference between the two groups.

Table 28

T-test Results: Student Overall Teaching Experience by Major

		Levene's test of Equality of Variances		t test of equality of means		
		F	Sig.	t	df	Sig. (2-tailed)
q5	Equal variances assumed	.194	.660	.726	98	.470
	Equal variances not assumed			.725	75.246	.471

CHAPTER VI

FINDINGS, IMPLICATIONS, RECOMMENDATIONS, AND CONCLUSIONS

This chapter begins with a discussion of the findings obtained from the faculty and student surveys as they related to the four research questions that were examined. Next, the researcher discusses the implications of the findings for different stakeholders, including IT departments, policy makers at the Ministry of Education, faculty, and coordinators of faculty development programs. A list of suggestions for further research is also provided.

Discussion of the Findings

The following discussion compares responses from the KSA respondents to findings from the ECAR survey completed by students and faculty in the United States, where data were available. Additional comparisons are made between student and faculty responses at universities in KSA. The discussion of findings is organized by research question.

RQ1: To what extent does the current IT infrastructure at the campus meet the needs of the faculty?

KSA Faculty are, by and large, relatively happy with the technology and support at their institution. In response to a question asking faculty to describe their overall technology experience at their institution, 68% of respondents rated their experience as good or excellent, and 28% rated poor or fair. However, this level of satisfaction is lower

when compared to faculty responses for universities in the United States where 71% rated their experience as good or excellent and only 18% rated it as poor or fair (Pomerantz & Brooks, 2017).

When asked about satisfaction with technology-enabled working and learning spaces, more than half of faculty were satisfied with services such as classroom-based technology resources (e.g., computers, projection systems, lecture-capture systems, SMART boards, etc.), laboratory or research-based technology resources (e.g., computers, research equipment, etc.), and online collaborative spaces in which your students or colleagues can work synchronously or asynchronously on projects.

A large majority were also satisfied with the physical collaborative spaces (e.g., computer labs, testing centers, research labs, active learning classrooms, etc.), access to institutional resources while working from home, ability to get my work done while working from home, and ability to get work done while traveling and/or living in other states or countries. However, only 39% were satisfied with access to institutional resources while traveling. One should also note that a large percentage of faculty (26%) said that they are not provided this service or that they have not used.

In terms of satisfaction with the technology-enabled connections and communication resources at their universities, most faculty members were pleased with the services offered. However, about 25% have not used video conferencing technologies; of those who used such technologies, only 57% rated them as good or excellent. In addition, approximately 43% of the respondents have not accessed remotely

software applications; of those who did have remote access, only 49% rated these services as good or excellent.

Faculty were also generally satisfied with the technology support services offered at their campus. More than 60% rated technology support and professional development related to use of technology in teaching as *good* or *excellent*. Yet, about one-fourth of the respondents report that they have not received support for making courses accessible to students with disabilities; of those who did receive such support, only half were satisfied with the support. Similarly, 25% have not used or did not have support for specialized teaching software. Of those who received support for specialized teaching software, only 44% were satisfied with the support received.

Lastly, faculty were generally satisfied with the classroom technologies available at their universities. About two-thirds of the faculty were satisfied with the availability of classrooms with multimedia equipment and more than half were satisfied with the reliability of equipment, the general use of instructor stations in the classrooms, the software installed on the instructor-station computers, and the computer projectors. However, less than half of the faculty gave favorable ratings to wireless access (46%) and clickers (47%).

RQ2: To what extent does the current IT infrastructure at the campus meet the needs of the students?

Similar to the responses received from faculty, students tended to be satisfied with their overall experience with technology at the current institution. Approximately 71% considered that their experience was good or excellent. Only 23% of the students rated

their experience as poor or fair. Yet, these findings revealed a slightly lower satisfaction than the 2017 ECAR Student Survey conducted in the United States (Galanek, Gierdowski, & Brooks, 2018), where 77% of the students surveyed reported either good or excellent overall technology experiences.

Overall, more than half of the students who used their mobile devices for various functions were satisfied with the university support for mobile devices. The highest satisfaction ratings were obtained for using learning management systems (72%), registering for courses (67%) and communicating with instructors (67%). Yet, a large percentage of students said that they did not access library services via their mobile devices (37%) or used mobile devices to register for classes (27%). Additionally, approximately two-thirds of the student report that they have not used mobile devices to pay tuition or fees.

When asked about satisfaction with the wireless networks on campus, only 40% report that the reliability of access to Wi-Fi in student housing was good or excellent. Only 31% were satisfied with the network performance and 28% were satisfied with the reliability of access to Wi-Fi in outdoor spaces. Satisfaction with the reliability of access to Wi-Fi was relatively low even in indoor spaces: 51% in campus libraries, 52% in classroom spaces, and 42% in other indoor spaces.

When compared to the results obtained by ECAR for students in the United States, the results indicated a large gap in satisfaction (Galanek et al., 2018). A larger percentage of the U.S. students rated the Wi-Fi connectivity as either good or excellent. Ratings of good or excellent were received from three-fourths of the respondents for Wi-

Fi reliability in campus libraries and from about two-thirds for reliability in classroom and instructional spaces. Satisfaction with Wi-Fi reliability in the dormitories was lower (about 50%), but still higher than the level reported by Saudi students (40%).

Students' opinions regarding their instructors' use of technology in the classroom show that technology is not extensively used in the classroom. About 35% of the students report that none or very few of their instructors use technology in face-to-face settings to engage them in the learning process. Likewise, 42% say that none or very few instructors encourage students to use their own technology devices during class to deepen learning (e.g., by searching online for related concepts, examples, or demonstrations).

It is also important to note that a large percentage of the students are not encouraged by their instructors to use technology in the classroom. For instance, a large percentage of the respondents say that none or very few instructors have them use the tablet (44%), smartphone (46%), and laptop (37%) as learning tools in the classroom. Saudi students were also asked to identify resources and tools that instructors should use more frequently in the classroom. The results indicated that students would like their instructors to use more learning management systems, e-books, and lecture capture. They would also like their instructors to allow more use of mobile devices in the classroom.

In contrast, the results from the ECAR study (ECAR, 2018) showed that students in the United States report a wider use of technology in the classroom by their faculty. For instance, more than half of the students agreed or strongly agreed that their instructors (a) use technology during class to enhance learning with additional materials,

(b) encourage them to use online collaboration tools, (c) use technology to engage them in the learning process, and (d) encourage me to use technology for creative or critical-thinking tasks.

There are similarities, however, between the Saudi and American students in that both populations tend to think that only few instructors let them use mobile devices in the classroom. For instance, only one fourth of the American students agree or strongly agree that their instructors let them use smartphones or tables in the classroom.

RQ3: How do faculty perceptions of the IT infrastructure vary based on geographical location of the university, gender, area of teaching, and socioeconomic status?

The researcher found no significant difference between male and female faculty with regard to their overall IT experiences at their universities. This is an encouraging finding given the KSA government's recent efforts to close the gender gap in education and the labor market. Similarly, the overall experience with IT did not vary significantly with the faculty member's income or area of teaching (STEM vs. non-STEM). However, the researcher did uncover that faculty teaching at universities outside the capital (particularly in the northern part of the country) generally have a worse experience with IT at their campus than faculty teaching in the capital (Universities 4 and 5). This reveals that there are geographic differences in the level of investment in technology infrastructure across the nation.

RQ4: How do student perceptions of the IT infrastructure vary based on geographical location of the university, gender, major, and socioeconomic status?

Similar to the findings obtained for faculty, the student survey revealed the overall experience with the IT infrastructure did not differ by gender, socioeconomic status, or major (STEM vs. non-STEM). Yet, the results did indicate students outside the capital (with a majority of them located in the northern part of the country) are less satisfied with the IT infrastructure at their campus than students studying in the capital city. This finding corroborates the results produced by the faculty survey, where a gap was found based on the location of the campus.

Implications

The findings of this study have practical implications for Information Technology departments at the sampled universities, the Saudi Ministry of Education, faculty and faculty development programs.

Implications for IT Departments

IT departments at the participating universities should improve Wi-Fi connectivity on their campuses. As the results from research question 2 indicate, students were largely dissatisfied with the reliability of the Wi-Fi connections at their institutions. Universities should invest in Wi-Fi networks to address students' needs and experiences. Students' overall experiences at their institution, not just the classroom experience or completion rates, are now part of ensuring student success. Consequently, network

quality may be a means for students to assess a higher education institution's investments in student experiences.

Without quality networks, campus-wide technology initiatives may be impacted. For example, colleges moving course materials from print textbooks to digital resources will likely need upgraded networks to meet the demands of increased student traffic to access and engage with materials. In addition to accessing digital textbooks, students spend a considerable part of their days connecting through their mobile devices—conducting business, accessing academic resources, completing tasks, communicating with family and friends, streaming content, listening to music, or gaming. Likewise, IT departments should expand faculty access to institutional resources when they travel.

Implications for the Saudi Ministry of Education

It is evident from both the faculty and student survey findings that universities in the northern part of the country do not have the same level of technology resources that universities in the capital city enjoy. Therefore, much attention should be paid to reducing geographic disparities in technological investments if the goals of Vision 2030 are to be materialized.

Implications for Faculty and Faculty Development

The student survey revealed that used of new technologies in the classroom is not as widespread as it is in U.S. universities. Moreover, Saudi students noted in their responses that they would like their instructors to use more learning management systems, e-books, and lecture capture. Therefore, universities need to direct their centers for teaching and learning, where available, to provide regularly faculty development

related to these technologies. Evidently, there is a gap between the new generation of students' needs for digital learning and the faculty capacity to provide such learning opportunities.

Recommendations for Future Research

The findings of this study were based on a relatively small convenience sample of faculty and students drawn from five universities. Therefore, the results cannot be generalized to the entire higher education sector in Saudi Arabia. Future research should employ random or stratified sampling techniques that ensure generalizability to the wider Saudi population of students and faculty.

Secondly, this research utilized only surveys as the main method of gathering opinions on the adequacy and use of information technology on campus. Future research studies should consider adopting a mixed methods approach where qualitative feedback about experiences with the technology is gathered via interviews or focus groups with students and faculty.

A qualitative approach involving such methods could provide an insight into the low ratings given by students in the survey response. In addition to gathering the opinions of faculty and students, future studies should also capture the perspective of IT leaders and staff. Obtaining feedback from these stakeholders could offer a good triangulation of the results generated from the faculty and student surveys.

Lastly, it important to study in more detail the gap in satisfaction that was found between universities in the capital and universities in the northern part of the country. A more realistic assessment of the disparities in the technology infrastructure could be

examined trough more objective measures, such as number of classrooms equipped with smartboards, percentage of instructors using learning management systems and availability of applications for mobile devices.

Limitations of the Study

The current study had several limitations that relate to the methodology employed that may have impacted the findings of the study, including threats to internal and external validity.

Firstly, as mentioned earlier, the sample used in this study is not representative of the KSA higher education sector. It is a convenience sample that is disproportionately focused on three universities: (Universities 1, 4, and 5) of the country. Therefore, the sample did not include a sufficient number of faculty and students from universities located in the rest of the country.

Secondly, the researcher was not able to obtain feedback from IT directors, thus some of the negative opinions expressed by the faculty, particularly in relation to the reliability of Wi-Fi networks, could not be explained. Thirdly, the questionnaires used in this study were adapted and translated from the ECAR faculty and student surveys conducted in the United States by ECAR. Some of the items related to the use of LMS and other digital instruction technologies might have received more favorable ratings in the United States since online programs and online courses have been in existence for much longer in this country than in Saudi Arabia. Therefore, the diffusion of these new technologies has reached a more advanced level in the United States than in KSA. It is normal then to expect lower usage of these technologies in the K.S.A universities.

Conclusions

This study examined satisfaction with and use of technology infrastructure by students and faculty across a sample of five universities in the Kingdom of Saudi Arabia. Overall, the findings indicated that both faculty and students were relatively satisfied with the IT infrastructure at their respective campuses, although they tend to report satisfaction levels than faculty or students in the United States. The study also revealed several areas of improvement, including the need for more reliable Wi-Fi networks on campuses and for the use of LMS and other digital technologies by the instructors.

Finally, the study uncovered disparities in the overall experience of faculty and students with IT between universities located in the capital city and universities outside the capital city. Additional studies are needed to further investigate such disparities by assessing resources available at various universities.

APPENDIX A

Faculty Survey

Survey Description

Technology is a critical part of all faculty roles. This study explores technology ownership, access, use patterns, and expectations as they relate to faculty roles. The results of this study can be used by colleges and universities to plan for technology shifts that influence faculty and better engage students in the learning process. Furthermore, institutions can use the data to improve IT services, increase technology-enabled productivity, prioritize strategic contributions of IT to higher education, and become more technologically competitive among peer institutions.

This survey asks questions about your experiences with and attitudes toward technology in the context of your faculty role. Your responses will help people on your campus and beyond understand how technology can benefit the academic community. There are no right or wrong answers; we would just like you to answer as honestly as you can. Participation in the survey is completely voluntary, and you can choose to exit the survey at any point. Your responses are anonymous. This survey might take you up to 15 minutes to complete.

Section I: Technology Infrastructure

1. Do you personally own—or does your institution provide you with—any of these devices? Select all that apply.

	Personally Own	Provided by my institution	Neither
Desktop	☐	☐	☐
Laptop	☐	☐	☐
Tablet	☐	☐	☐
Smartphone	☐	☐	☐

2. Thinking about the past year, please rate your experiences with the following technology-enabled learning/working spaces provided by your institution:

	Service not offered	Haven't used in the past year	Poor	Fair	Neutral	Good	Excellent
A. Classroom-based technology resources (e.g., computers, projection systems, lecture-capture systems, SMART boards, etc.)							
B. Laboratory or research-based technology resources (e.g., computers, research equipment, etc.)							
C. Online collaborative spaces in which your students or colleagues can work synchronously or asynchronously on projects or assignments (e.g., the learning management system [LMS], Google Docs, Dropbox, OneDrive, Office 365, etc.)							
D. Physical collaborative spaces (e.g., computer labs, testing centers, research labs, active learning classrooms, etc.)							
E. Access to institutional resources while working from home							
F. Access to institutional resources while traveling and/or living in other states or countries							
G. Ability to get my work done while working from home							
H. Ability to get my work done while traveling and/or living in other states or countries							

3. Thinking about the past year, please rate your experiences with the following technology-enhanced connection and communication resources provided by your institution:

	Service not offered	Haven't used in the past year	Poor	Fair	Neutral	Good	Excellent
A. Reliable access to Wi-Fi networks throughout campus							
B. Communication technologies (e.g., e-mail, instant messaging, social media, etc.)							

	Service not offered	Haven't used in the past year	Poor	Fair	Neutral	Good	Excellent
C. Videoconferencing technologies (e.g., Skype, Google Hangouts, Adobe Connect, other web-based conference services)							
D. Online or virtual technologies (e.g., network or cloud-based file storage system, web portals, etc.)							
E. Remote access (as opposed to locally install) to commercial software applications (e.g., MATLAB, GIS applications, statistical software, graphics software, textual or image analysis programs, etc.)							

4. Thinking about the past year, please rate your experiences with the following technology support services provided by your institution:

	Service not offered	Haven't used in the past year	Poor	Fair	Neutral	Good	Excellent
A. Technology support (e.g., desktop support, classroom technology support, course media production support, etc.)							
B. Professional development around the integrated use of technology in your teaching, whether face-to-face or online (e.g., technology training opportunities, incentives, and professional advancement)							
C. Support for making courses accessible to students with disabilities							
D. Professional development and training opportunities around the integrated use of technology in your research							
E. Individualized consultations for using technology in teaching (e.g., course design, assignment development, assessment and evaluation, etc.)							

	Service not offered	Haven't used in the past year	Poor	Fair	Neutral	Good	Excellent
F. Individualized consultations for using technology in research and scholarship (e.g., data analysis, management, and visualization, etc.)							
G. Specialized teaching software							

5. Rate your satisfaction with the following classroom technologies at your institution:

	Very Dissatisfied	Dissatisfied	Neutral	Satisfied	Very Satisfied	N/A
A. Availability of classrooms with multimedia equipment						
B. Reliability of equipment available						
C. General ease of use of instructor stations						
D. Computers in the instructor stations						
E. Software on the instructor-station computers						
F. Computer projection						
G. Audience response systems (clickers)						
H. Wireless access						

6. How would you describe your overall technology experience at your institution?

Poor ☐
Fair ☐
Neutral ☐
Good ☐
Excellent ☐
Don't Know ☐

7. What is ONE thing you would like *your institution* to do with technology to enhance your academic success?

8. What is ONE thing you would like *your instructors* to do with technology to enhance your academic success?

Section II. Demographics

9. What is your university?

10. Where is your campus located?

11. Age

30 or younger	☐
31-40	☐
41-50	☐
51-60	☐
Over 60	☐

12. Gender

Male	☐
Female	☐

13. How would you rate your family monthly income?

Low ($533 to $1,333 US dollars)	☐
Middle ($1,334 to $ 2,667 US dollars)	☐
High (more than $2,667 US dollars)	☐

14. Academic Position

Instructor	☐
Lecturer	☐
Assistant Professor	☐
Associate Professor	☐
Professor	☐

15. In what area(s) are the courses included in your current faculty load? Select all that apply.

Agriculture and natural resources	☐
Biological/life sciences	☐
Business, management, marketing	☐
Communications/journalism	☐
Computer and information sciences	☐
Education, including physical education	☐
Engineering and architecture	☐
Fine and performing arts	☐
Health sciences, including professional programs	☐
Humanities	☐
Liberal arts/general studies	☐
Manufacturing, construction, repair, or transportation	☐
Physical sciences, including mathematical sciences	☐
Public administration, legal, social services	☐
Social sciences	☐
Other; please describe:	☐

APPENDIX B

Student Survey

Study Description

Technology is a critical part of undergraduate students' experiences in higher education. This study explores technology ownership, use patterns, and expectations as they relate to the student experience. Colleges and universities can use the results of this study to better engage students in the learning process. Furthermore, institutions can use the data to improve information technology (IT) services, increase technology-enabled productivity, prioritize strategic contributions of IT to higher education, plan for technology shifts that impact students, and become more technologically competitive among peer institutions.

In this survey, we ask questions about your experiences with and attitudes toward technology and your academic experiences. Your responses will help people on your campus and beyond understand how to use technology more effectively to benefit students. There are no right or wrong answers; we would just like you to answer as honestly as you can. Participation in the survey is completely voluntary, and you can choose to exit the survey at any point. Your responses are anonymous. This survey is expected to take about 15 minutes to complete.

Section I – Technology Infrastructure

1. Thinking about the past year, please rate your institution's support of the following activities you've performed or experienced on a handheld mobile device (e.g., Smartphone or tablet).

	Service not offered/does not function on my mobile device	Haven't used in the past year	Poor	Fair	Neutral	Good	Excellent
A. Accessing library resources							
B. Checking grades							
C. Accessing course content (e.g., syllabus, recorded lectures, supplemental learning materials, e-texts, podcasts, blogs)							

	Service not offered/does not function on my mobile device	Haven't used in the past year	Poor	Fair	Neutral	Good	Excellent
D. Using the learning management system (e.g., Blackboard, Moodle, Sakai, D2L Brightspace, Canvas)							
E. Registering for courses							
F. Reviewing transcript							
G. Making tuition/fee payments							
H. Accessing information about events, student activities, and clubs/ organizations							
I. Providing identification to access campus facilities or services							
J. Verifying/recording attendance for class or campus activities							
K. Using e-texts							
L. Communicating with instructors about class-related matters outside class sessions							
M. Taking notes in class							
N. Answering questions posed in class to generate/tally automatic responses							
O. Participating in interactive class activities (e.g., group discussion, collaborative writing)							
P. Producing content (e.g., documents, spreadsheets, presentations, videos)							

2. Thinking about the past year, please rate your experiences with wireless networks on campus:

	Poor	Fair	Neutral	Good	Excellent	N/A
A. Reliability of access to Wi-Fi in student housing/dormitories						
B. Reliability of access to Wi-Fi in campus libraries						
C. Reliability of access to Wi-Fi in classroom/instructional spaces						

	Poor	Fair	Neutral	Good	Excellent	N/A
D. Reliability of access to Wi-Fi in other indoor public spaces						
E. Reliability of access to Wi-Fi in outdoor spaces						
F. Ease of login to Wi-Fi network(s) provided by the institution						
G. Network performance (e.g., high speed, no interruptions)						

3. Thinking about your college/university experiences within the past year, how many of your instructors…

	N/A or don't know	None	Very few	Some	Most	Almost all	All
A. ….use technology adequately for course instruction							
B. …use technology in face-to-face settings to engage you in the learning process							
C. …use technology during class to make connections to the learning material or to enhance learning with additional materials (e.g., by providing audio or video examples/demonstrations/simulations of learning concepts)							
D. …encourage you to use your own technology devices during class to deepen learning (e.g., by searching online for related concepts, examples, or demonstrations)							
E. …encourage you to use online collaboration tools to communicate/collaborate with the instructor or other students in or outside class							
F. ...encourage you to use technology for creative or critical-thinking tasks							
G. ...have you use your tablet as a learning tool in class							
H. ...have you use your smartphone as a learning tool in class							
I. ...have you use your laptop as a learning tool in class							

4. Which resources/tools do you wish your instructors used less…or more?

	Don't know	(Less) 1	2	3	4	(More) 5
A. Learning management system (e.g., Blackboard, Moodle, Sakai, D2L Brightspace, Canvas)						
B. Online collaboration tools to communicate/collaborate						
C. E-portfolios						
D. E-books or e-textbooks						
E. Free, web-based content to supplement course-related materials (e.g., OpenCourseWare, Khan Academy, iTunes U, YouTube, etc.)						
F. Simulations or educational games						
G. Lecture capture (i.e., recording lectures for later use/review)						
H. Student laptops as learning tools for course-related activities						
I. Student tablets as learning tools for course-related activities						
J. Student smartphones as learning tools for course-related activities						
K. Social media as a teaching and learning tool						
L. Software to create videos or multimedia resources as a learning tool for course-related activities						
M. Early-alert systems designed to catch potential academic trouble as soon as possible						
N. Search tools to find references or other information online for class work						
O. Textbook Publisher electronic resources (e.g., quizzes, assignments, tutorials, homework, practice problems)						
P. In-class polling tools (e.g., clickers, Poll Everywhere, SMS-based tools)						

5. How would you describe your overall technology experience at your institution? Poor

Poor ☐

Fair ☐

Neutral ☐

Good ☐

Excellent ☐

Don't Know ☐

6. What is ONE thing you would like *your institution* to do with technology to enhance your academic success?

7. What is ONE thing you would like *your instructors* to do with technology to enhance your academic success?

Section II: Demographic Questions

8. What is your university?

9. Where is your campus located?

10. Level of Study: Undergraduate ☐ Graduate ☐

11. Your Gender: Male ☐ Female ☐

12. How would you rate your family monthly income?

    Low ($533 to $1,334 US dollars) ☐

    Middle ($1,334 to $2,667 US dollars) ☐

    High (more than $2,667 US dollars) ☐

13. In what area is your major? Select the one that is the closest match to your primary major.

    Agriculture and natural resources ☐

    Biological/life sciences ☐

    Business, management, marketing ☐

    Communications/journalism ☐

    Computer and information sciences ☐

    Education, including physical education ☐

    Engineering and architecture ☐

    Fine and performing arts ☐

Health sciences, including professional programs	☐
Humanities	☐
Liberal arts/general studies	☐
Manufacturing, construction, repair, or transportation	☐
Physical sciences, including mathematical sciences	☐
Public administration, legal, social, and protective services	☐
Social sciences	☐
Other major not described above	☐
Undecided	☐

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