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Article

Evaluating the future of digital and Face-to-Face Communication on student motivation: Implications for human resource roles in AI-driven Oman higher education

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Abstract: The present research focuses on researching the impact of the diverse communication media that facilitate or develop Student Motivation and Engagement in the educational systems of the states in the Gulf, especially Oman. The main goal of this work is to determine which type of method is most effective in encouraging students in view of cultural and technological factors present in the region. Comparisons using hypothesis testing and structural models which provided higher *T* value for Technology-Based Communication Methods (TBCM) and Human Face-to-Face Communication Methods (HFtFCM). Next, the research hypothesis H2 that TBCM has a direct positive relationship with SMaE was supported by the following regression coefficients: $\beta = 0.177$, $t = 4.493$; $p = 0.000$. On the other hand, there was no effect of HFtFCM on SMaE as indicated by a regression coefficient of 0.056 ($p < 0.124$) for this hypothesis and therefore, this hypothesis was rejected. The analysis using the mediator of Student Perception of Communication Effectiveness (SPoCE) only partly mediates TBCM and SMaE ($\beta = 0.047$, $t = 3.737$, $p = 0.000$). However, SPoCE was found not to moderate the relationship between HFtFCM and SMaE ($\beta = -0.01$, $t = 1.125$, $p = 0.005$). The present study underlines the efficiency of TBCM in the area of student engagement, while face-to-face conversation does not play significant part in this process. The obtain results conclude that, the traditional and technological evolution in the Gulf region supports the adoption of TBCM in educational systems. Such approaches support with the technological learning and likings of students, offering greater flexibility and engagement. Educational systems must highlight TBCM to better meet the growing needs of their student, while identifying that face-to-face remains important, though secondary, in energetic motivation.

Keywords: technology-based communication methods; human face-to-face communication methods; student perception of communication effectiveness; student motivation and engagement; Oman higher education

1. Introduction

Effective communication is considered to be a crucial and necessary component in creating an effective educational system (Miranda et al., 2021). Taking this into consideration, there is a certain urgency to understand and study the communication process more systematically, primarily because of the diverse attitudes towards the use of communication in different educational systems in this region (Ataguba and Ataguba, 2020). Such AI and digital communication integration in advanced societies is making drastic changes in industries, including learning institutions (Alshamsi et al., 2024; Arai, 2024; Awwad, 2024). The scenario in GCC countries presents a challenge of instilling in higher education students' employable skills that engages them to perform in a world that requires technology and associated face-to-face and

online communications solutions (Shannaq, 2024a). Nonetheless, the current educational systems of the region continue to evolve to meet these dynamics, which make students' motivation, interest, and readiness for the future markets driven by AI a question of concern. Importance for GCC Countries: Due to their attempts to diversify their revenue sources and break the over-dependency on oil, GCC countries require a skilled workforce with advanced technological know-how . Training students for both artificial intelligent and human methodologies will not only ensure learners secure better jobs in the job market but also support the realization of national development aspirations like Saudi Vision 2030 and Oman Vision 2040 with an emphasis on digital transformation. The engagement is paramount to the future growth of the Southeast Asian region in terms of economic and social development since students should be ready to live in the world powered by artificial intelligence (Shannaq et al., 2024). According to modeling theories, the determination of behaviors depends on three variables: Personal factors, situational factors, and modeling factors (Abdullah et al., 2018; Chon and Park, 2021). Behavioral modeling for desirable behaviors is implemented directly most of the time. It is conscious and learned behavior, but it can be affected by intentional teaching. In another approach, it is shown that desirable behaviours may become habitual behaviours by shaping the environment according to this goal (Al-Shamsi et al., 2024; Sabbir and Taufique, 2022). Social learning theory and modelling studies draw attention to the fact that the observed behaviour and the reinforcement of this behaviour affects the learning outcomes. The term "Student Engagement" is often expressed in many higher education-related discussions throughout the world. Student engagement, as it is used in high-level educational research, defines a wide range of processes (Bond et al., 2020). Academic engagement, social engagement, and engagement in extracurricular activities are just a few of the areas, as many have focused on student involvement (Hofkens and Wang, 2020). In Singapore, as in many countries, the Ministry of Education has been looking for new strategies to maximize student involvement in educational institutions and is constantly working to increase students' academic performance (Tay et al., 2021). In the ever-evolving modern world, communicating with information technology has proven to be the most favored instrument. The higher education context also adapts to this change: With the introduction and increasing widespread use of learning management systems, digital communication has found its way into higher education (Nafisah et al., 2024). However, the high level of digital communication does not mean that less advanced and traditional communication methods are obsolete. On the contrary, there is a tendency to rediscover direct Face-to-Face Communication. This Face-to-Face Communication may be accompanied by digital media, for example, in blended learning courses (Singh et al., 2021). We are discussing ways to increase higher education students' learning effects and motivation using both digital and Face-to-Face Communication. Several findings confirm that direct communication is more effective and motivational for students, while digital and direct communication are found to be equally motivating in our mixed student sample (Gajendran et al., 2022; Goksel and Kilinc, 2024). There is also a strong tendency among professors to adopt digitized communication, such as learning management software for lecturing and organizing their courses, in order to demonstrate their technological knowledge (Núñez-Canal et al., 2022). However, this

may not necessarily take into account the students' learning and motivational behavior (Ahmadi et al., 2023). The main purpose of this research is to evaluate the differences between digital and Face-to-Face Communication Methods concerning their impact on student motivation and to demonstrate the relative significance of these methods when the effects of various direct and digital communication variables on student motivation are evaluated within the current communication technologies and cultural context. The study also pays special attention to the different communication message delivery problems in the direct and digital communication methods that may arise due to different communication technology infrastructures and cultural differences. While creating or structuring courses with digital materials, it may be wise to acknowledge that students' motivational and learning behaviour may be significantly influenced by digital communications. If Face-to-Face Communication is preferred instead, its additional benefits must also be considered to be effective. Therefore, the need has emerged to find scientific evidence that determines the extent to which digital or Face-to-Face Communication impacts students in educational institutions in the Sultanate of Oman (Awwad, 2024; Shannaq, 2024b). There is very scarce literature focusing on the communication type and its ability to enforce students and synthesizing the cultural context in Oman. There are few empirical investigations of the differences between technology-supportive and Face-to-Face Communication for motivating students and how these research-finders fit cultural and students' tech-savviness. It has been found that in many Arab cultures, especially in Oman, communication significantly impacts students and motivates them in their education systems. Thus, the importance of communication emerged as a key influential factor on students and its adoption in educational institutions. Students in Oman accept and use contemporary technologies primarily focused on digital communication (Saini and Salim Al-Mamri, 2019). New technologies that have found their way into education include mobile applications, social media, Email, and many more. On the other hand, Face-to-Face Communication in human interpersonal mode is still considered most important (Hinze et al., 2023). The challenge here is to determine which type of method is most effective in encouraging students in view of cultural and technological factors present in the region. In a related context, the research questions based on the aforementioned problem can be summarized as follows:

1) What are the most effective digital technologies to motivate students in Oman's educational institutions?
2) Which is more effective in motivating students in educational institutions in Oman: Using digital technologies or Face-to-Face Communication?

As is well-known among researchers in the scientific field, research questions serve as a key foundation for setting research objectives. The research questions evaluated digital and Face-to-Face Communication to determine the most effective method. Thus, the research objectives can be summarized in the points below:

1) To assess whether technology-based methods of communication facilitate increased motivation and engagement from students.
2) To evaluate the effectiveness of human Face-to-Face Communication aids on students' motivation.

3) To evaluate the students' attitudes toward the efficiency and adequacy of technology-mediated synchronous and asynchronous communication technologies.

Figure 1 describe the connection between problem, research questions and objectives.

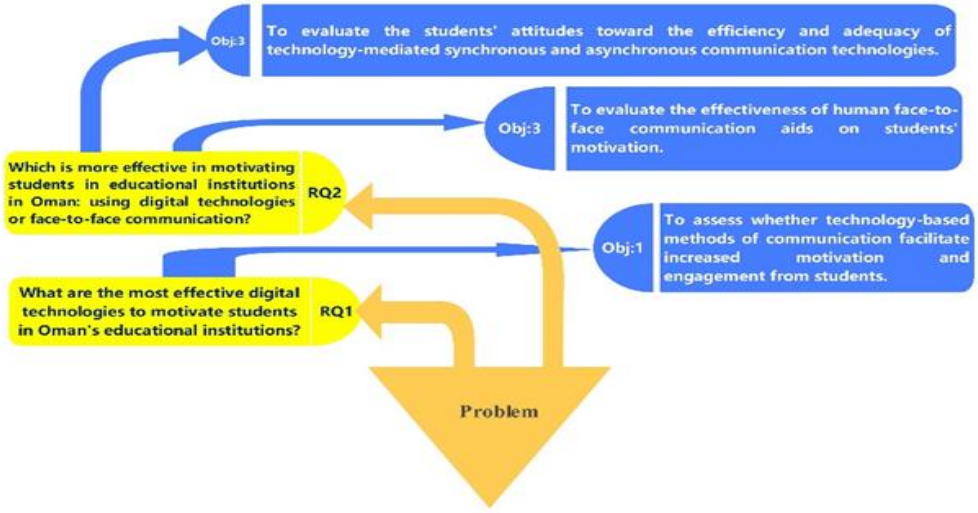

Figure 1. Problem design.

The outcomes of this work will contribute to empowering the following demands of the digital era:

- Preparing for future workforce: When the roles that AI is beginning to take in various industries are considered, it is equally important to prepare students for the roles that are filled, both by technology and human beings, in the increasingly interconnected world of work and learning.
- Bridging communication gaps: Cultural literacy maximizes an incumbent's and future professionals' ability to work synchronously both online and offline, particularly in light of the trends towards creating the AI-driven society.
- Enhancing Human-AI synergy: Flexible and coherent communication with both unconstrained AI instruments and colleagues will differentiate learners, shaping their success in sophisticated AI environments.
- Fostering critical thinking and adaptability: To properly adapt to technological changes, students must be ready for AI revolution; otherwise, organizations will have to start from scratch while communication and motivation remain human-centered.
- Shaping tomorrow's leaders: Equipping students with the suitable communication and AI competencies to be future professionals focused to significantly transform the future of education, business and technology in the Oman.

2. Literature review

Educational institutions in Oman increasingly use digital communication technologies to engage and motivate students.

In this context, concerns arise regarding the impact of digital communication versus traditional face-to-face interaction, and the potential ramifications of these advancements on human resource roles in higher education (Al Matari et al., 2023). A lack of awareness of the consequences of prescribing approaches to learning for academic achievement is imperative for learners in nations like Oman, where AI is progressively finding its way in learner curricula (Rodríguez-Fernández et al., 2023).

There is an understudied type of communication that goes along with the informational-more regulatory model of modernized bureaucratic education. This type of communication involves the transmission of knowledge without dialogue, which is typical of the informative-didactic model. While this paradigm is capable of efficiently transferring knowledge, it often fails to provide the necessary stimulation for students to learn and develop their critical and analytical thinking (Bakhtin, n.d.; Bruggeman et al., 2021). On the other hand, dialogic communication involves the establishment of an engagement between teachers and students and an engagement process that assists in the creation of higher-level thinking and personal academic skills—vital in today's world skill-based economy (Wegerif, 2013).

This means that the assimilation of AI in higher learning institutions in Oman has over the years facilitated the use of several emergent digital communication technologies, such as online platforms and applications of artificial intelligence. These forms of teaching have eliminated the face-to-face method of teaching that has dominated the market for so long. Such tools can enhance evenly distributed interactions with the coursework and bring a unique perspective on delivering learning to the learner. However, a basic question is how these tools influence students' analysis and creativity, particularly given the current preferences in using artificial intelligence for academic purposes.

In addition, writers like Martin Buber, who laid emphasis on dialogue in educational communication as the best form of interaction, imply that interaction that is deep establishes understanding. Heidegger also emphasized the importance of dialogue engagement in fostering critical thinking. In assessing possible policies regarding these technologies in universities, human resources professionals must distinguish between digital and direct communication (Shaver, 1973).

In conclusion, the shift toward AI-driven digital communication in education calls for a balanced strategy that reinforces the role of human resources in guiding the application of these tools. Educational decision-makers in Oman must carefully consider how to integrate AI to support teacher-student interaction without compromising the critical and reflective capacities essential to student development

Communication with students

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Based on this framework, we propose the following hypotheses:

H1: Technology-Based Communication Methods (TBCM) positively affect Student Motivation and Engagement (SMaE).

H2: Human Face-to-Face Communication Methods (HFtFCM) positively affect Student Motivation and Engagement (SMaE).

H3: Student Perception of Communication Effectiveness (SPoCE) mediates the relationship between TBCM and SMaE.

H4: SPoCE mediates the relationship between HFtFCM and SMaE.

Figure 2 describe the Proposed Conceptual framework.

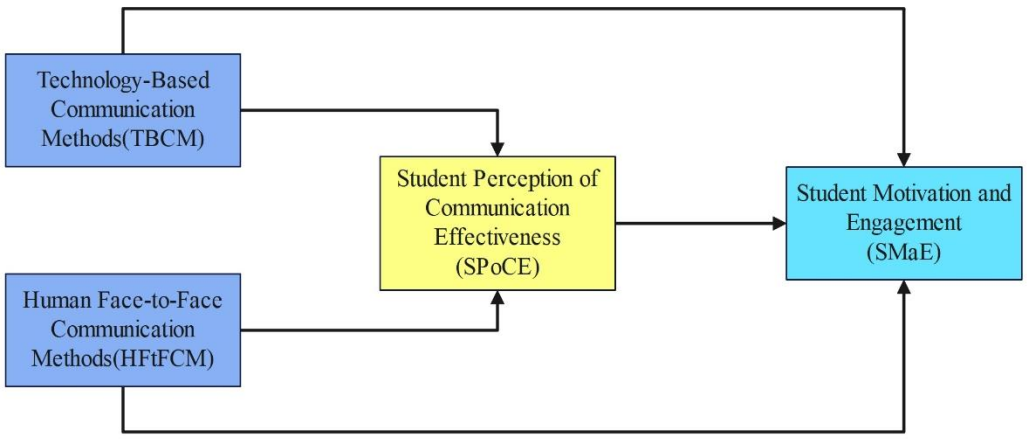

Figure 2. Conceptual framework.

3. Materials and methods

This part seeks to clarify the research approach applied in this work. In the first step, we examined various studies on communication with students using digital and conventional face-to-face techniques to identify the research gap this project would handle (Shakir et al., 2024). After that, we developed the research questions and determined the research topic under examination. The earlier parts provide justifications for all these components. In the second step, we developed the questionnaire to fit the goals of the research and carried out a pilot study to guarantee dependability of the study.

At the end of the second phase, we organized the final version of the questionnaire. The study's target population, higher education students in the

Sultanate of Oman, received the questionnaire in the third phase. The Oman academic environment consists of a number of institutions that represent a significant social and cultural network in Oman states. The uniformity of the academic environment results in most other demographic traits not equally represented among students to be statistically negligible. This fact forced us to review our first demographic study and apply a theme discussion technique to validate the survey responses.

We are convinced that, from the beginning of the data analysis, there is no other study that has collected data from some institutions in Oman that is strictly limited to students within the sample size; the survey found a total of 4454 students. We gather and scrutinize the data to address the research questions and accomplish the objectives of the study. Oman's sample fits very nicely in terms of cultures, laws, beliefs, and traditions with other Gulf Cooperation Council (GCC) nations. Rooted firmly in Islamic and Arab cultural legacies, Oman shares with other GCC countries a great focus on family values, respect for authority, and communal ties. This cultural cohesiveness increases the validity of extending survey results to a larger Gulf setting. These shared roots, together with comparable legal and social systems, show that Oman's tendencies are probably applicable in other GCC countries, even if local quirks may cause particular differences.

In terms of education, economic systems, and communication patterns that shape public behaviour and policy orientation in the region, Oman likewise has characteristics with its GCC neighbors. Oman, for instance, has comparable political and social goals, hence digital engagement and social actions influenced by technology usually mimic trends in surrounding countries. Therefore, even though Oman-specific data might not fully reflect all subtleties throughout the GCC, they offer a good basis for partial generalizations and understandings of regional patterns. The final phase involved interpreting the results, testing the hypotheses, and identifying the accepted hypotheses and their degree of acceptance. This led to the formulation of the study's final recommendations, as illustrated in **Figure 3**.

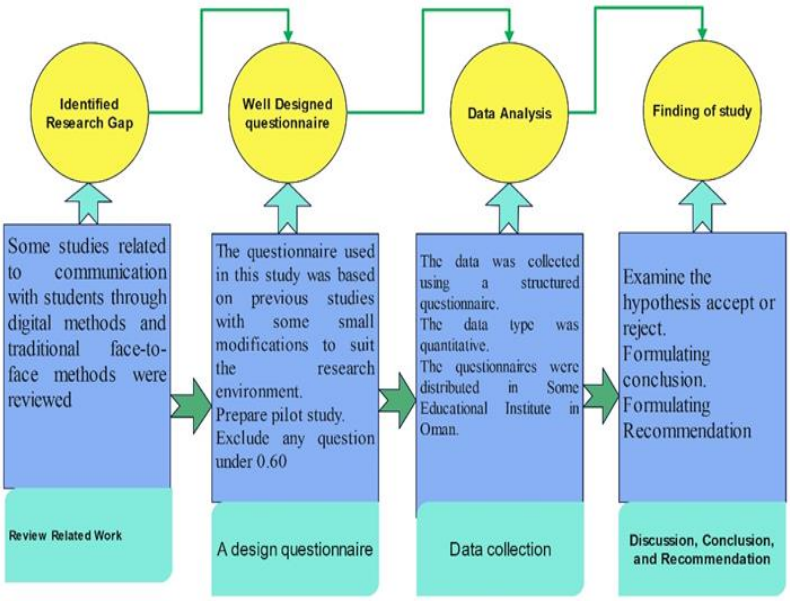

Figure 3. Research methodology.

3.1. Research design

The research applied the input, process, and product evaluation model. At the beginning, the researchers confirmed through literature the different results of feedback to students and then carried out some cultural contrasts to demonstrate this fact. From these results, a second model was developed defining the communication process with different cultural points of view. The second questionnaire evaluated the different ICT-based methods and direct teaching that could be used preferentially to motivate students. The results provided infrequent data that depended especially on the type of university and the range of subjects and methods used in the teaching and learning process. The objective was to compare the university management objectives with the methods used in the university teaching and learning process.

The model applied by this piece of research can be described as follows. The first question is the measurement of students' perception about the process of communication received as feedback from the teacher and the educational organization. The questionnaire asked for information about improvement of benefits and types received using different methods. The first attempt was to define with intentionality the methods selected and verify the bias generated. The second question is the research into the cultural and technological factors that influence the type of communication with the student that has been defined in the first step of the research. The third question concerning cultural and technological factors described the different communication methods proposed to verify method utilizations in combination with the communication aspect, considering place, time, and communication devices. A new model was created to analyze the perceived quantity of time for each method. The third iterative model simplifies and/or combines the most used methods of communication.

3.2. Data collection methods

To evaluate the impact of potential digital and direct communication methods on student motivation, we use a two-stage data collection case study approach. Although case study research in the field of business and management is a multifaceted, contested, and contrasting area, data collection methods vary from quantitative research. Certainly, case studies are particularly suitable for the practical nature of our research covering the territories of a university's national administrative structure. In our attempt to balance the dual use of data collection methods and data used, we collect data in two stages.

During our first data collection, we construct and evaluate a thematic motivation coding scheme that could potentially be suitable for use in another stage of the university case. Our primary objective is to extensively analyze the institutional data and examine its implications. This will lead us to derive a comprehensive set of digital and direct communication tools, which are highly likely to have a significant impact on student motivation in the dynamic context of Oman universities. Through meticulous and thorough research, we aim to gather data on the effectiveness and usage of potential digital and direct communication motivational tools directly aligned with our institutional strategic goals.

Moreover, as part of our commitment to creating an inclusive and student-centered learning environment, we also recognize the importance of gathering perspectives from the administrative staff responsible for the standard operation of the department. These diligent staff members serve as the usual initiators of the motivation procedures received from the students in regard to the motivational methods utilized. By incorporating their valuable insights, we strive to enhance the effectiveness of our motivational strategies further. To ensure the reliability and validity of our findings, we commenced by piloting the coding scheme on a select number of responses. After several iterations and refinements, we successfully managed to fine-tune the coding scheme, enabling us to confidently apply it to the comprehensive national data we have gathered.

This crucial second stage of data collection aims to not only explore the advantages of digital tools in motivating students but also to consider and evaluate the potential application of direct communication methods in conjunction with the aforementioned digital and direct communication motivational tools. By synergistically blending these two approaches, we aim to effectively address the institutional strategic goals in a manner that fosters student motivation and success.

3.3. Data analysis techniques

The final customer survey was to be composed of three key sections: Demographics, habits, and perceptions. The demographics section aimed to better understand the end users of the report and analyzed how certain demographic characteristics influence preferences for communication channels. Fourteen questions were part of this section, and some of the questions included the respondent's age, gender, nationality, primary language, education level, residence area, industry, and job title. Habits was the second part, and it was designed to understand which platforms are top of mind for participants. Some of the survey questions for habits included asking about devices used for communication, the top three features of phones, and the approximate data usage limits by networks. The final portion was created to get general user perceptions and was formed of four questions, namely: Is the preferred channel convenient? Can their needs be met on it? Can they work faster and better on a reserved channel? As well as the estimated frequency of usage.

In the last question pertaining to demographics, the participants' response was, "Do others do what the preferred channel user does"? The point of the question being: If I can use my preferred communication channel, but others do not talk back in kind, then currently I cannot freely use my preferred communication channel. However, if the respondents could always use their preferred communication channel, then effectively, the need for this survey report is minimized.

After a questionnaire, Likert-type scale data are collected in response to a questionnaire that consists of a number of items measuring the same latent variable. Modeled here are three techniques to determine the factor structure of such scales: Factor Analysis, Correlation, and Principal Component Analysis. The primary purpose of factor analysis is to obtain a shared response or explanation to a response by considering the components underlying the observed variables. Its secondary objective is data reduction. An exploratory analysis by Factor Analysis or Principal Component

Analysis is normally used before assessing the scale. But after the factor structure has been determined by Factor Analysis, the confirmatory factor analysis or the consistent objective tests would handle the new assessment for the scale. Factor analysis is implemented on the actual data in order to examine the behavior of items in a specified domain.

Each scale (questionnaire item) is tested for the following goodness-of-fit criteria: Items of the factor structure and the items-factor correlation. The goodness of the item fits was assessed through two statistical tests: The Square Multiple Correlation and the model statistics. The Square Multiple Correlation is the basis for establishing the factor correlation by comparing it to a table value for degrees of freedom at a predefined level of significance. A commonly used threshold is $p > 0.01$. The result of Factor Analysis should be supported by an agreement of these selection criteria; otherwise, the removal of an item from the latent variable is recommended.

To control for the possible variation in the level of students' digital engagement across colleges in the university, we purposively recruited colleges from across the levels. To minimize the possibility of participants' biasing their answers in the survey, we came up with neutra/questions and these were screened by experts in the respective fields. Additionally, we conducted preliminary testing to ensure the clarity of questions and adjusted them based on feedback to improve objectivity and minimize response bias.

4. Data analysis and results

4.1. Model of assessment: Measurement model

4.1.1. Validity and reliability

The internal consistency reliability was estimated using Cronbach's alpha coefficient while Composite reliability (CR) estimated the authenticity of the data that was given. When the dataset was first developed, items which had factor loadings of less than 0.700 were included in the analysis. (For example, 1.5SPoCE: 0.456; 2.5TBCM: 0.204). Any entries of this kind were not in the dataset after some time. Example of the method that is being described can be observed from the two pictures, **Figure 4** which is taken before the removal process and **Figure 5** which is taken after the removal process. This investigation made Cronbach's Alpha and Composite Reliability (CR) as the findings of reliability tests. That this finding was made possible is due to the extensive testing conducted with AVE and HTMT. In addition, the factor loadings linked to each of the remaining items are stated in **Table 1**, as well as the overall reliability and validity of such items. It is safe to conclude that the pattern of dependability that is up prove by all the alpha values and by the CR; which is superior to the advised cutoff magnitude of 0.700. Information regarding the convergent validity was apparent and averting validity was furnished by the AVE and CR value which could be equal or more than 0.500 and 0.700, respectively. By the analysis of factor loadings being greater than cross-loadings for all items it was inferred that the cross-loadings had discriminant validity. This conclusion was arrived first by making use of the cross loadings.

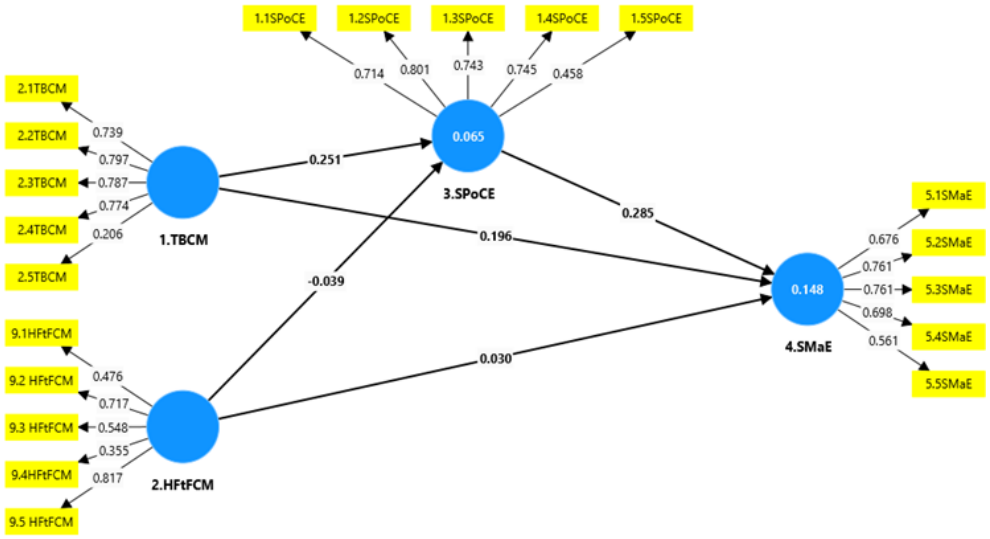

Figure 4. Factor loading (primary data).

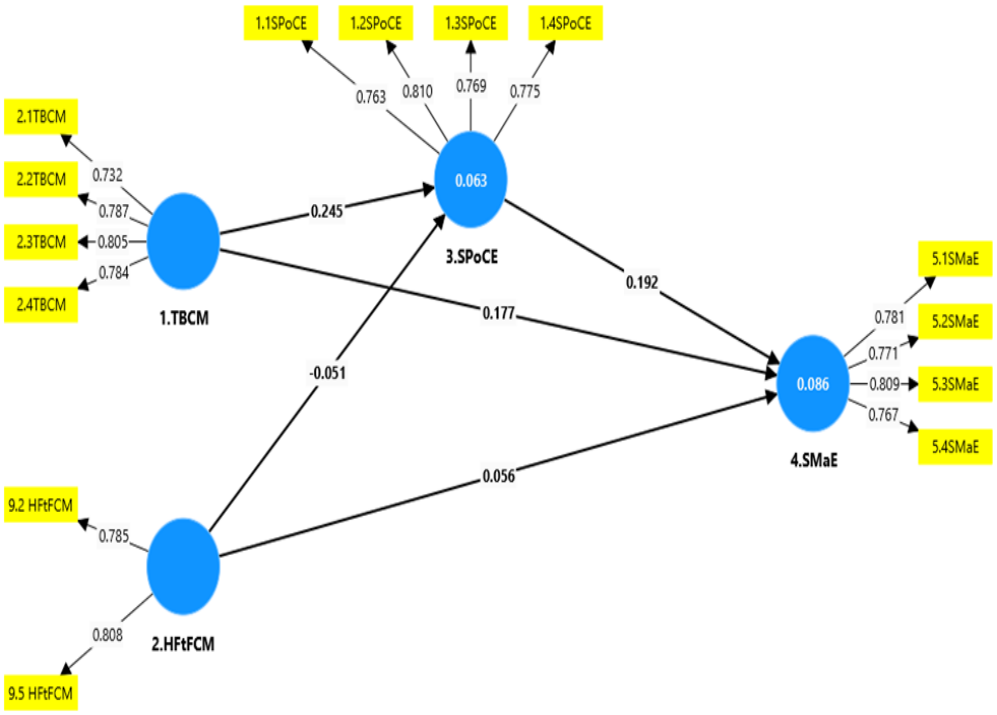

Figure 5. Factor loading (After removal items < 0.7).

Table 1. Item loadings, reliability, and validity.

	Factor Loading	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)	Average variance extracted (AVE)
Technology-Based Communication Methods (TBCM)		0.789	0.803	0.859	0.605
2.1TBCM	0.733				
2.2TBCM	0.787				
2.3TBCM	0.805				
2.4TBCM	0.784				

Table 1. (*Continued*).

	Factor Loading	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)	Average variance extracted (AVE)
Human Face-to-Face Communication Methods (HFtFCM)		0.426	0.426	0.777	0.635
9.2HFtFCM	0.793				
9.5HFtFCM	0.801				
Student Perception of Communication Effectiveness (SPoCE)		0.788	0.802	0.861	0.608
1.1SPoCE	0.763				
1.2SPoCE	0.810				
1.3SPoCE	0.769				
1.4SPoCE	0.776				
Student Motivation and Engagement (SMaE)		0.79	0.803	0.862	0.61
5.1SMaE	0.763				
5.2SMaE	0.779				
5.3SMaE	0.811				
5.4SMaE	0.77				

4.1.2. Predictive validity

Discriminant validity analysis for the current study is summarized in two different approaches; the heterotrait-monotrait ratio (HTMT) and Fornell and Larcker criteria. This, therefore, provided evidence for the validity of predictive validity as well as for discriminant validity. HTMT is presented in **Table 2** for all heterotrait combinations, and Fornell and Larcker criteria presented in **Table 3**.

Table 2. Heterotrait-monotrait ratio (HTMT).

	1.TBCM	2.HFtFCM	3.SPoCE	4.SMaE
1.TBCM				
2.HFtFCM	0.175			
3.SPoCE	0.274	0.114		
4.SMaE	0.265	0.095	0.283	

Table 3. Fornell and Larcker.

	1.TBCM	2.HFtFCM	3.SPoCE	4.SMaE
1.TBCM	0.778			
2.HFtFCM	−0.026	0.797		
3.SPoCE	0.246	−0.057	0.780	
4.SMaE	0.223	0.041	0.233	0.782

4.2. Model of assessment: Structural model

In the next step of our investigation we used an analysis of the structural models to check the presented hypotheses. Thus, applying the bootstrapping procedure, the direct hypothesis (H1) and (H2) was checked, based on the obtained results from table.

It has been found that Technology-Based Communication Methods (TBCM) positively affect the Student Motivation and Engagement (SMaE) level (B = 0.177, t = 4.493, p = 0.000). H1 was supported and accepted.

Also, it has been found that Human Face-to-Face Communication Methods (HFtFCM) doesn't affect the Student Motivation and Engagement (SMaE) level (B = 0.056, t = 1.56, p = 0.124), therefore H2 was rejected, as well as the mediation hypothesis (H3 and H4). As indicated in the next sections, the H1 hypothesis was assessed using the bootstrapping results presented in **Figure 4** and **Table 4**.

Table 4. Testing hypotheses directly (H1 and H2).

	Original sample (O)	**Standard deviation (STDEV)**	***T* statistics (|O/STDEV|)**	***P* values**	
1.TBCM → 4.SMaE	0.177	0.039	4.493	0	Accepted
2.HFtFCM → 4.SMaE	0.056	0.049	1.156	0.124	Rejected

4.3. Mediation analysis

Figure 6 confirms the implementation of the mediation analysis using "Bootstrapping". **Table 5** presents the results of testing (H3 and H4). SPoCE mediate the TBCM → 4.SMaE and SPoCE mediate the 2.HFtFCM → 4.SMaE.

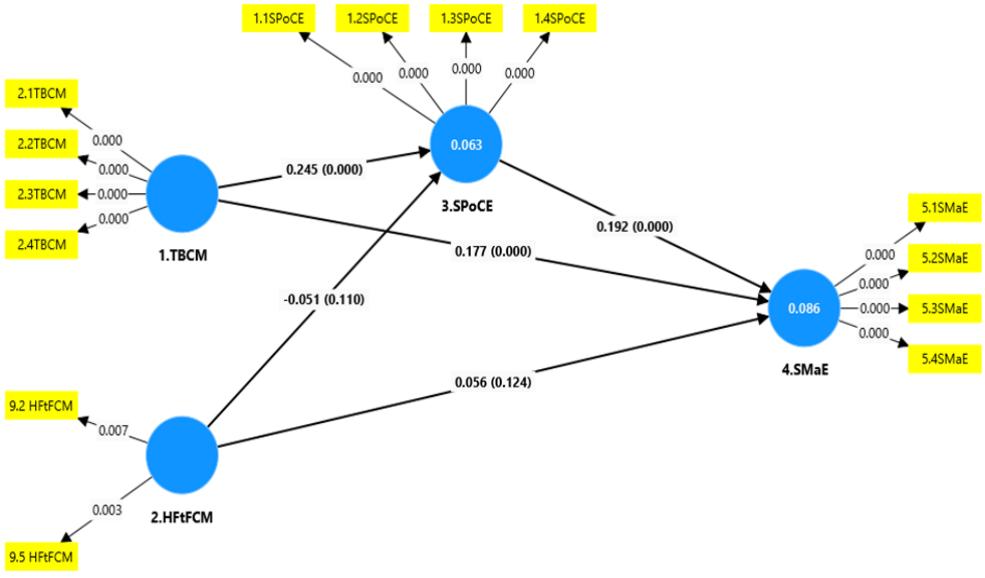

Figure 6. Bootstrapping implementation for mediation analysis.

Table 5 describes the demonstrate the summary (Mediator analysis H3: TBCM → 3.SPoCE → 4.SMaE and H4: 2.HFtFCM → 3.SPoCE → 4.SMaE).

Table 5 shows the mediator analysis for H3 and H4, concerning the extent to which SPOCE mediates the relationship between the communication methods and SMaE.

Table 5. Result summary (mediator analysis).

Total effect		**Direct Effect**		**Specific indirect effect**						
B	***P***	**B**	***P***	**Hypothesis**	**B**	***t***	**UL**	**LL**	***P***	**Results**
0.224	0.000	0.177	0.00	H3: **TBCM → 3.SPoCE → 4.SMaE**	0.047	3.737	0.028	0.069	0.000	Partial Mediation **H3: Accepted**
0.046	0.175	0.056	0.124	H4: **2.HFtFCM → 3.SPoCE → 4.SMaE**	−0.01	1.125	−0.02	−0.023	0.005	No mediation **H4: Rejected**

H3: The results reveal a total effect of 0.224, and a direct effect of 0.177 when their significances are estimated by their p-values with 0.000. The significance of the specific indirect effect (0.047, p = 0.000) suggests that partial mediation occurs between Technology-Based Communication Methods (TBCM) and SMaE through SPoCE. Hypothesis H3 is supported hence we conclude that SPoCE partly mediates the relationship between TBCM and student motivation.

H4: Human Face-to-Face Communication Methods (HFtFCM) have less total and direct effects; the total effect being 0.046 and the direct one 0.056. The specific indirect effect = −0.01 and is not significant at p = 0.005 hence proposing no mediation. Hypothesis H4 is also not supported suggesting that SPoCE does not moderate the HFtFCM to SMaE relationship.

Justification and decision

Therefore, with the mediating role of SPoCE, Technology-Based Communication Methods (TBCM) are more advantageous than Face-to-Face Communication Methods in increasing student motivation. This resonates with our suggestion to evaluate the effectiveness of communication approaches in Gulf education structures especially the Oman. According to the study conclusions, specific emphasis should be placed on the technology-based types of communication in educational processes with the goal to increase the learners' interest. Though the face-to-face interaction is critical, the mediator effect of students appears to dampen the overall impact it has on motivation.

5. Discussion

The increased and excessive use of digital applications among students has made mobile phones or laptops an integral and highly significant part of their personal belongings. Data collected in Oman shows that students spend at least three hours daily engaging and interacting with their mobile devices. The emergence of AI-related apps has led several students to depend on digital interactions for decision-making, especially for daily life choices. This reliance has expanded to soliciting ChatGPT for guidance on academic subjects of interest, psychological issues, or many personal challenges encountered every day. For a large number of students, their engagement with digital apps has progressed from basic contact to meaningful, engaging discussion. As a result, this contact with digital—particularly intelligent—applications have evolved into a type of digital discourse, having a substantial impact on many parts of students' life. Thus, the findings of this study are critical for decision-makers, as they provide insights that might drive the adoption of technology or the creation of processes and strategies to support successful student involvement, resulting in

optimal outcomes. Hence when looking at the effects of the various communication methods on the SMaE in the gulf region and the Oman it is worthy to note the cultural and technological background. From **Tables 1** and **2**, we are in a position to highlight on the contextual effectiveness of Technology-Based Communication Methods (TBCM) and Human Face-to-Face Communication Methods (HFtFCM). Our research question is toward which approach is best suited specifically in consideration of the sociocultural context and changing technological landscape of the Gulf countries.

5.1. The impact of Technology-Based Communication Methods (TBCM)

From **Table 1** accompanied with the direct hypothesis testing, it can be seen that the TBCM had a significant impact on the SMaE with beta coefficient of 0.177, *T*-statistic 4.493 as well as *p*-value 0.000. This proves that TBCM is very efficient and has positive effect on students and their engagement with assignments. As the main argument for using the current result is rather important, it also indicates that while adopting advanced technological aspects in the Gulf region the use of digital approaches such as the mobile application, social media, and email are effective for motivating students.

From the same **Table 2**, the mediation analysis upholds the TBCM explanation by showing that while TBCM has a positive direct effect on SMaE, SPoCE partially mediates the relationship with corresponding indirect effect coefficient of 0.047, p = 0.000. This means that positive perception of students on the effectiveness of Technology-Based Communication also strengthens the influence on students' motivation and engagement. From a cultural perspective, this means that members of the Gulf community, especially students of the education systems now embrace technology especially through the adoption of new technologies as a way of communicating in their academic institutions.

5.2. The role of Human Face-to-Face Communication Methods (HFtFCM)

The main hypothesis H1 stated that, HFtFCM has positive direct effect on SMaE, however, from **Table 4**, the direct impact of HFtFCM had no significance (β = 0.056, T =1.156, p =0.124), thus, the main hypothesis will be rejected. In addition, as **Table 5** indicates, there is no mediating role of SPoCE between HFtFCM and SMaE (indirect effect = −0.01, p = 0.005) to support the argument that Face to Face Methods are less effective here.

This is somewhat contrary to expectation because most cultures in the Arab world are physically interactive hence the core values are often anchored on interpersonal relations. Yet, it can be a result of the physical environment in the Gulf States which is going through the process of rapid transition associated with modernization, tendency towards technology and younger population demanding appropriate educational approaches. Although still highly appreciated in terms of establishing trust and providing individual support, Face-to-Face Communication do not appear to be enough these days in attempting to motivate and engage students, especially in settings where technology appears to be part of the learning equation.

5.3. Analysis of TBCM vs. HFtFCM

There remain a number of critical determinants that distinguish Technology-Based Communication from Human Face-to-Face Communication Methods. The highest proportion of the documents that distinguish between Human Face-to-Face and Technology-Based Communication in an organizational context assesses the communication method on a conceptual basis. The first characteristic distinguishes between technology-based and human Face-to-Face Communication Methods. The so-called lean communications have many advantages, such as the employment of cutting-edge technology and a broad availability of virtual tools. In addition to these advantages, Technology-Based Communication Methods also offer increased efficiency and flexibility, allowing individuals to communicate across geographical boundaries and time zones effortlessly. Moreover, the use of Technology-Based Communication platforms enables instant sharing of information and real-time collaboration, enhancing productivity and fostering effective teamwork. Furthermore, these communication methods provide individuals with the opportunity to maintain a permanent record of conversations, making it easier to track and refer back to important discussions and decisions. The virtual nature of Technology-Based Communication also eliminates the need for physical presence, reducing travel costs and promoting environmental sustainability. Additionally, Technology-Based Communication Methods facilitate the inclusion of diverse perspectives and voices, ensuring equal participation and representation in discussions and decision-making processes. Furthermore, these methods allow for the seamless integration of multimedia elements, such as videos, images, and interactive presentations, enriching the communication experience and enhancing the clarity and impact of messages. Lastly, Technology-Based Communication Methods offer the convenience of asynchronous communication, meaning individuals can engage in discussions and exchange information at their own pace and convenience, resulting in greater flexibility and personalization. Overall, Technology-Based Communication Methods present a wide range of advantages that contribute to efficient, effective, and inclusive communication in today's fast-paced and interconnected world.

Reducing communication time barriers and costs, enabling real-time information exchange, and disclosing company information to employees are essential factors for fostering a healthy worker-patient relationship. Moreover, providing apps for internal and external communication and utilizing all available technological and team tools for participative decision-making also play a pivotal role in establishing such a relationship. It is of utmost importance not to underestimate the significance of extensive live communication when it comes to promoting a friendly and cooperative atmosphere among internal customers. However, it is often the case that this significance is disregarded, and requests for personal interaction are dismissed by resorting to technological means for other forms of communication. Nonetheless, it should be noted that the expansive use of technology is only necessary in scenarios where individuals are geographically distanced from each other, preventing them from engaging in face-to-face discussions. In many instances, participants might never have the chance to meet their colleagues or customers, thereby missing out on the advantages that come with personal interactions. Consequently, the benefits derived

from intimate conversations are lost when technology is excessively relied upon for communication purposes.

5.4. Cultural and technological factors in the region

There has been a marked trend in digitization over the past few years in the gulf countries including Oman, whereby organizations have increased their investment in the technology platform and mobile devices and Internet applications have become integrated with business processes. This is in consistent with the studies that TBCM is more effective to encourage the students. These methods suit the region's young people well as they are computer literate and they consider the methods as flexible, as they can receive an instant feedback or has a wider access to materials to learn from.

From a cultural perspective, interpersonal communication, especially face-to-face interaction, had been the principal in Arab societies; however, this is gradually changing with expansion in digital communication. The direct communication channel is becoming more acceptable among younger students; particularly those in the urbanized areas of the gulf. This may explain why; HFtFCM did not demonstrated significant positive impact on SMaE in the present study.

The Gulf region's rapid technological advancement and widespread mobile penetration have made Technology-Based Communication Methods (TBCM) the most effective tool for student engagement. Students increasingly prefer communication methods that integrate seamlessly into their daily lives, such as social media and mobile apps, as these tools offer convenience, flexibility, and immediate access to academic activities.

5.4.1. Recommendations

Therefore, it is suggested that the educational institutions in the Gulf region should make more use of technological means of communication with the students. Educational providers should use the various applications on mobile devices, social networks, and e-mail for better collaboration with learners. Moreover, there is a need to enhance students' attitudes towards those methods of communication by constant feedback and interaction. There should also propose training for instructors, to improve their potential into employing Technology-Based Communication more effectively for the purpose of addressing students' needs.

5.4.2. Future work

Another possibility for further studies is to study more advanced effects of TBCM on different academic indicators, including effectiveness and student dropout rates. Moreover, more research could be aimed at comparing the differences in the approach to the communication with students in different Arab countries and to determine to which extent the approaches differ and whether they influence students' motivation or not. Further research should also examine how hitherto adopted asynchronous and synchronous blended communication styles may affect interest and academic achievement across different learning environments.

6. Conclusion

Consequently, the findings of this study show differentiated technology-enhanced communication strategies can significantly enhance the motivation and, hence, the engagement of students compared to face-to-face conversations in the context of the Oman education system. All three technology-based methods, mobile application, social media and emails, have a direct positive effect on students' engagement, and this is supported by the students' positive perception of communication effectiveness (SPoCE). The growing students' acceptance and dependence on technology in education marks a fundamental change in how they interact with knowledge. Many technology-driven elements support this tendency; there are apparent differences in the influence of these elements across urban and rural locations and between various age groups.

The main force behind encouraging technology usage in education is the great availability of smart devices such as computers, tablets, and cell phones. These tools improve the experience of self-directed and autonomous learning by allowing faster and more easy access to instructional materials. The Internet underscores the significance of technology-enhanced student engagement in education. It enables students to access a diverse array of educational resources in virtual learning settings. While urban regions sometimes exhibit superior coverage compared to rural areas, the accessibility of high-speed Internet fluctuates considerably.

Advances in e-learning systems such as Coursera, Moodle, and Google Classroom have greatly impacted the delivery of educational content. These websites, equipped with various interactive tools, online courses, and tests, enable students to select the skills that best suit their preferred learning style and speed. This is especially true in several domains where students enter the job market with a competitive advantage in technology. This transition ensures the active incorporation of technology in the classroom to help students be properly prepared to face an employment world. Therefore, a significant gap has emerged in the technical environment between urban and rural areas. Students in urban areas have much easier access to modern technology and rapid internet, while those in rural areas struggle even to obtain a rapid internet connection and quality digital tools for learning. This mismatch explains why standard programs and solutions are insufficient to close the technology gap in education. Urban institutions will more often than not have better resources put in place to support online learning. Therefore, rural towns may require more resources to meet the needs of their students, which could potentially encourage the integration of technology in the classroom. The fellows in high school and college would be more receptive to embracing technology since they were born and raised with it. The fact that they are able to adjust to new methods of teaching with new technology should calm those of us worried about the future of education with emerging technology.

On the other hand, mature learners, including professional or postgraduate learners, may require some form of orientation to the use of technology in learning. One could attribute this to the requirement for mature learners, such as professional or postgraduate students, to possess more knowledge about modern tools and technical skills compared to their younger counterparts. The increase in technology in teaching

is a pedagogical change that cannot be separated from technology access. However, adoption has differential distribution patterns between urban and rural areas and across different age brackets. This therefore highlights the need to develop programs for some of these tools to support learning in the classroom that take into consideration these differences. In addition, there is no direct or moderated relationship between Face-to-Face Communication Methods and student motivation. This then means that even as face-to-face interaction is still prevalent, it may not satisfy the engagement demands that contemporary students have, particularly within a number of online learning paradigms. This is an important aspect we are likely to find as the adoption of technology in our classrooms increases in order to enhance the learning outcome, there will be need to implement technology with communication strategy.

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