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# Culturally inclusive prototyping for higher education institutions: navigating language and gender dynamics

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**ABSTRACT**

This article explores the crucial intersection of cultural inclusivity in designing and developing e-learning prototypes for Higher Education Institutions (HEIs) in developed countries, such as Saudi Arabia (SA), emphasizing language and gender dynamics. It delves into the deliberate design of prototypes that accommodate linguistic diversity and address gender biases prevalent in educational systems. Real-world examples illustrate innovative solutions institutions use to navigate the complexities of language and gender dynamics during the prototype design process. Notably, the prototypes discussed have undergone rigorous evaluation, ensuring they meet technical benchmarks while aligning with the diverse linguistic and gender aspects inherent to developed nations. By synthesizing cultural sensitivity with cutting-edge design, this article encourages educators, developers, and decision-makers to adopt holistic approaches in creating HEI prototypes. Incorporating cultural inclusivity fosters equitable learning environments and positions higher education to be both forward-thinking and deeply rooted in the cultural tapestry it serves.



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## 1. INTRODUCTION

With the advent of the COVID-19 threat, numerous governments enforced isolation and social distancing measures, causing global social and economic repercussions [1]. Millions have adhered to staying at home to curb the pandemic's spread. A consequential outcome of these measures has been the hindrance of students attending educational institutions. Technological progress played a pivotal role in adapting the conventional learning paradigm, with e-learning emerging to sustain the educational process amid closures prompted by the COVID-19 pandemic [2]. Consequently, educational institutions accelerated the adoption of various educational platforms. However, this expedited adoption presented challenges, as specific platforms failed to align with the cultural needs of these developing countries [3], [4]. Transitioning to e-learning is commendable, yet it faces significant challenges in developing countries' Higher Education Institutions (HEI). These challenges stem from inadequate technological infrastructure readiness, Internet issues, and limited bandwidth, resulting in subpar virtual classes and online lectures [4].

Moreover, researchers highlighted that current learning platforms within HEIs in developing countries are deficient, exhibiting incomplete functionality and obstructing the utilization of its potential tools [5]-[7]. Therefore, in the fast-paced evolution of HEI, the design and development of prototypes stand as critical milestones in shaping the future of education [8]. As these institutions strive for innovation and adaptability, it becomes essential to consider the intricate cultural dimensions within developed countries [8], [9].

This article focuses on the intersection of cultural aspects, specifically language and gender, in designing and developing prototypes for HEIs.

The complexity of language and gender dynamics in developed nations requires thoughtful prototype creation [3]. As a cornerstone of cultural identity, language adds communication challenges beyond technical aspects. A successful HEI prototype must embrace linguistic diversity for inclusivity and address gender biases in traditional educational systems [3], [10]. Simultaneously, the evolving discourse on gender inclusivity challenges HEIs to address and overcome biases embedded in traditional educational systems [3], [11].

Culture shapes HEI design preferences and practices, influencing communication and priorities [3], [8]. Diverse beliefs and customs create varied behaviors [10], leading to potential communication issues among clients, engineers, and practitioners from different backgrounds [9]. Recognizing these social and cultural impacts is crucial for successful software development, highlighting the need to explore these influences during implementation [8]. Researchers have highlighted significant deficiencies in current learning platforms in developing countries [5]-[7]. These platforms often lack complete functionality and fail to accommodate linguistic diversity and gender considerations, creating barriers to equitable access and inclusivity in learning [3], [12]-[15].

This paper's importance came from the lack of culturally responsive prototyping frameworks; there is a notable gap in comprehensive prototyping frameworks that specifically address the intricate nuances of language diversity and gender dynamics within the higher education landscape of developing countries [12], [16]. Also, there is an insufficient consideration of linguistic diversity, as the current prototypes frequently overlook the rich linguistic diversity present in universities of developing nations, where multiple languages and dialects coexist, failing to cater to the varying language preferences of learners [17]. Further, existing prototypes often neglect the unique gender dynamics and deeply rooted cultural norms surrounding gender roles in the societies of developing countries, potentially reinforcing gender biases or inequities in the learning experience [18].

Moreover, research highlighted a pressing need for culturally sensitive design principles that can guide the development of the prototypes tailored to the specific needs, preferences, and socio-cultural contexts of HEIs in developing countries, as generic design approaches may fail to effectively address local complexities [13]. Finally, there is a limited knowledge sharing and replicability as research on culturally inclusive CBVLE prototyping within the unique contexts of developing nations remains limited [12], [19], hindering the sharing of best practices and the replicability of successful approaches across regions with similar socio-cultural considerations.

As HEIs in developing countries strive for innovation and adaptability in the rapidly evolving educational landscape, it has become increasingly crucial to consider the intricate cultural dimensions, particularly language and gender dynamics, that profoundly influence the design and development of effective learning solutions [8], [9]. This article explores how institutions can navigate these critical cultural aspects in prototyping, emphasizing culturally sensitive best practices that promote inclusivity, equity, and resonance with local contexts.

This article explores how institutions navigate language and gender dynamics in prototype development, emphasizing culturally sensitive best practices. It aims to inspire developers and decision-makers to adopt approaches that meet technical benchmarks and align with linguistic and gender diversity in developed nations' HEIs. Utilizing SA as a representative case among developing countries, the paper exemplifies integrating cultural considerations into prototype design, aligning with its unique education policy rooted in Islamic Sharia principles [20]. Focusing on SA's distinctive approach to prioritizing human dignity and adherence to Islamic values, the study provides practical insights for prototype design within HEIs. This case study serves as a valuable illustration, guiding the incorporation of cultural values to meet diverse needs in developing nations. The synthesis of cultural inclusivity with cutting-edge prototype design aims for an education system that is both forward-thinking and deeply rooted in its cultural context. By addressing these gaps, researchers and developers can contribute to creating culturally inclusive prototypes that promote equitable access, inclusivity, and an empowering learning experience for all students in Saudi HEIs, regardless of their language proficiency or gender. This research endeavor has the potential to serve as a model for other regions grappling with similar socio-cultural complexities in educational technology adoption [21].

## 2. LITERATURE REVIEW

Some developing countries like SA have a unique education policy rooted in Islamic Sharia principles, prioritizing human dignity and adherence to Islamic values [20], [22]. Singh *et al.* [22] discussed the establishment of a committee for lifelong education and training to realize sustainability goals and promote global citizenship and cultural diversity. Despite the strong influence of religion and culture, the

country remains responsive to global shifts in the economic and academic spheres. Education and culture are deeply intertwined, shaping individuals' educational choices and employment prospects [22]. Overall, SA's educational and cultural landscape reflects its societal values and aspirations, with education as a driving force for development and sustainability.

Studies highlight the cultural impact on HEI technologies and systems [3], [23], [24]. Hofstede [10] described culture as "the collective programming of the mind distinguishing one group from another". Culture shapes beliefs, values, norms, and behaviors within communities and organizations [25], influencing the acceptance or delay of new technology [3]. Previous research has consistently shown that cultural contexts affect technology adoption [26], with one philosophy fitting a specific local culture not necessarily suiting another [3].

The Ministry of Education in SA ensures high-quality education for both genders but segregates female and male education in line with Sharia law [20]. Universities and HEIs offer synchronous distance learning with real-time interaction through multimedia systems. Female students and male instructors are in separate locations, using teleconferencing to adhere to gender separation norms. This technology aims to enhance interaction and improve the learning experience. However, there is a shortage of professionals, with most HEIs exclusive to one gender and limited mixed-gender facilities. New technologies are needed to address this professional shortage [27].

Recognizing the cultural context of stakeholders is crucial for understanding their needs during requirements elicitation [28]. In countries like SA, female opinions might be overlooked. Engineers should identify gender-related differences in software requirements, ensuring inclusivity by incorporating special functions and ample resources. They must be educated on both the gender and cultural backgrounds of stakeholders and have a deep understanding of software domains [28]. Several previous studies suggest a need to investigate further the role of gender in adopting cloud computing, especially in developing countries. Almazroi *et al.* [12] mention that gender has been a research focus in developing countries, including SA, highlighting notable gender differences. Specifically, male citizens demonstrated higher acceptance of technology than their female counterparts.

On the other hand, studies show that thoughts can vary between languages, with our native language significantly influencing our thinking. Therefore, it is unfair to expect Arabic-speaking HEI users to achieve the same results as native English speakers using an English-delivered VLE [3]. In SA's HEIs, where English is the medium of instruction, non-native English-speaking students encounter challenges. Some use camera-based language translation apps to understand lecture materials. Still, these apps can hinder learning due to integration issues and difficulties following classroom discussions, especially for remote students [29].

In a study on cloud computing adoption in SA, cultural influences impacted attitudes and behaviors toward adoption decisions [25]. Cultural and geographical differences are also significant factors to consider when adopting cloud computing technology [30]. Karim and Rampersad [7] highlighted that cloud-based computing in SA often overlooks local requirements and needs. Therefore, decision-makers consider cultural influences when adopting this technology, especially within Saudi educational systems [31]. Transitioning from exploring cultural influences in SA's education policy, we now delve into the implications of these cultural nuances on the design of innovative prototypes within HEIs in the following section.

## 3. THE PROTOTYPE

Given the framework's intricate nature and extensive scale, a prototype has been created to assess a portion of it. The prototype aims to elucidate certain concepts before implementing a collaborative virtual learning environment. To achieve the objective, the researcher actively participated in the university's "Virtual Campus" project. Significant contributions were made, particularly in designing and evaluating the prototype. The focus was on aligning the prototype with cultural influences relevant to the teaching and learning environment, explicitly emphasizing language and gender-related requirements.

In prototype design, Activity diagrams, a key tool in prototype design from the unified modeling language (UML), visually represent the flow of activities in a software system. These diagrams graphically depict user interactions, sequence of actions, and decision points, aiding in planning, understanding, and communicating dynamic aspects. They are instrumental in ensuring the prototype's alignment with the intended design, showcasing the logical flow of tasks. Activity diagrams are commonly applied in requirements engineering and prove especially useful for modeling intricate processes without conflicting logical operations [32]. Draw.io [33] software helped in creating the following main prototype activity diagrams:

### 3.1. User log in

User login involves entering the email ID and password chosen during sign-up. Considering the cultural impact, it's recommended that two prototype interface versions be developed and customized based

on gender. This acknowledges differences in educational experiences for male and female students and lecturers, including variations in course availability and participation in events. Thus, implementing separate homepages tailored to gender-specific needs is more convenient. The system verifies login information against the database, confirming a successful sign-in and directing users to the relevant homepage based on user type and gender. Refer to Figure 1 for the activity diagram illustrating this process.

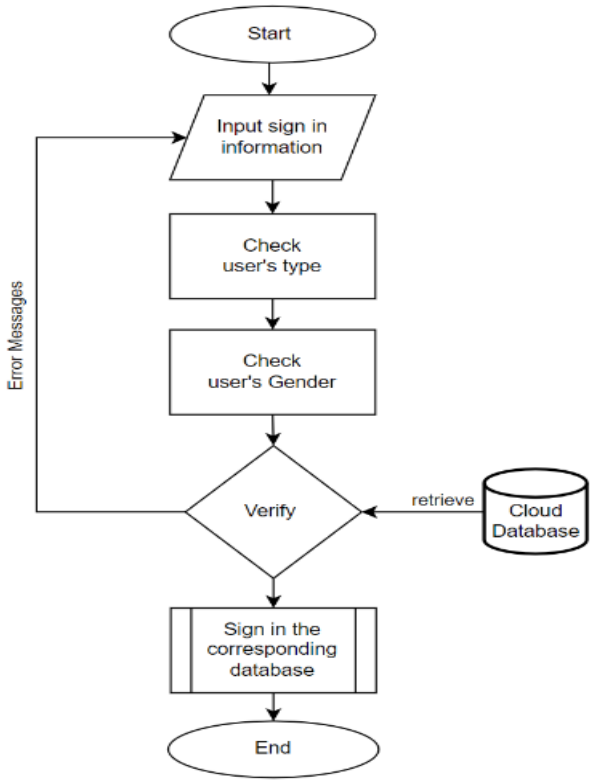


Figure 1. User login

### 3.2. Manage registration (language)

Arabic is the predominant spoken language in SA, but English is essential for business communications and universities. However, most universities' specialties are divided into two significant paths: Humanities and Scientific specializations. The academic track for humanities specializations uses Arabic as the medium of instruction, including specializations like psychology, Qur'an and Islamic studies, Arabic linguistics, and more [34]. Some users prefer navigating in their mother tongue, so a language option is necessary for their settings preferences. Lecturers will provide two resource versions based on the specialization path: Arabic for humanities specializations and English for scientific specializations, catering to users' language preferences and academic paths. Thus, while registering for a new course, the system needs to check the path first to consider the language and the students' preferences, and if the class is full, the student needs to seek a different group or timing. This process is illustrated in Figure 2.

### 3.3. Manage registration (gender)

As previously mentioned, gender segregation is strictly enforced in SA's HEIs, prohibiting cross-gender communication on physical campuses, especially within governmental institutions. This entails a complete restriction on interaction between instructors and students of different genders. To provide additional clarification, female instructors exclusively teach female students, and in the event of staff shortages, a male instructor can only conduct online sessions for female students. Similarly, male instructors exclusively teach male students in online or physical courses. Refer to Figures 3 and 4 for a visual representation of this concept from both the student and administration perspectives. Consequently, a gender option must be included in the prototype's settings section. During the course registration process, the platform should generate an error message if a male student attempts to register for a session led by a female instructor and vice versa.

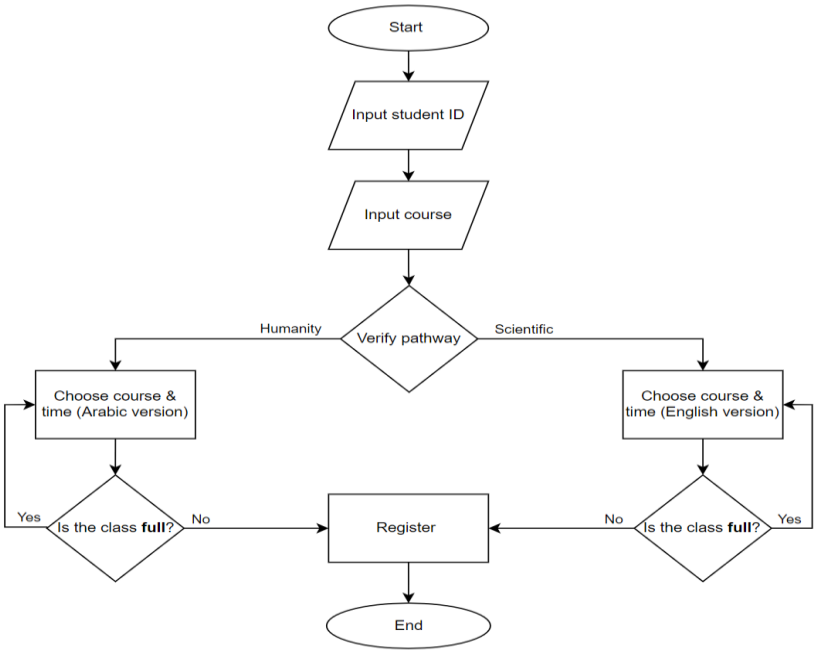


Figure 2. Manage registration-language

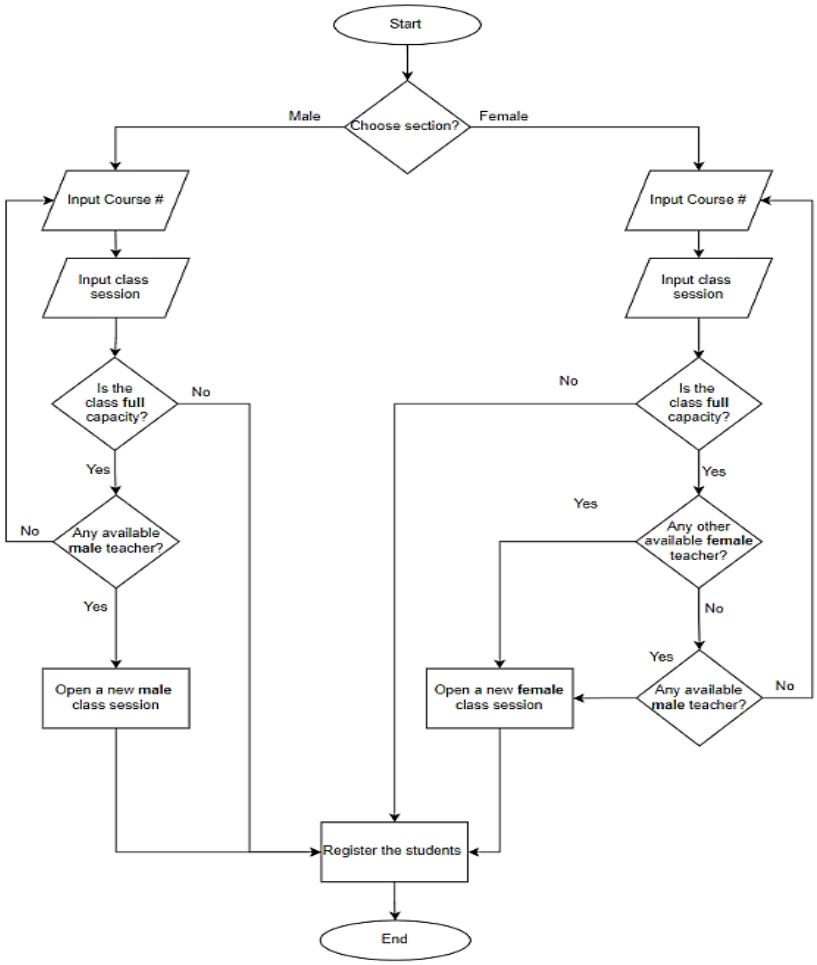


Figure 3. Managing sessions and teachers (administration portal)

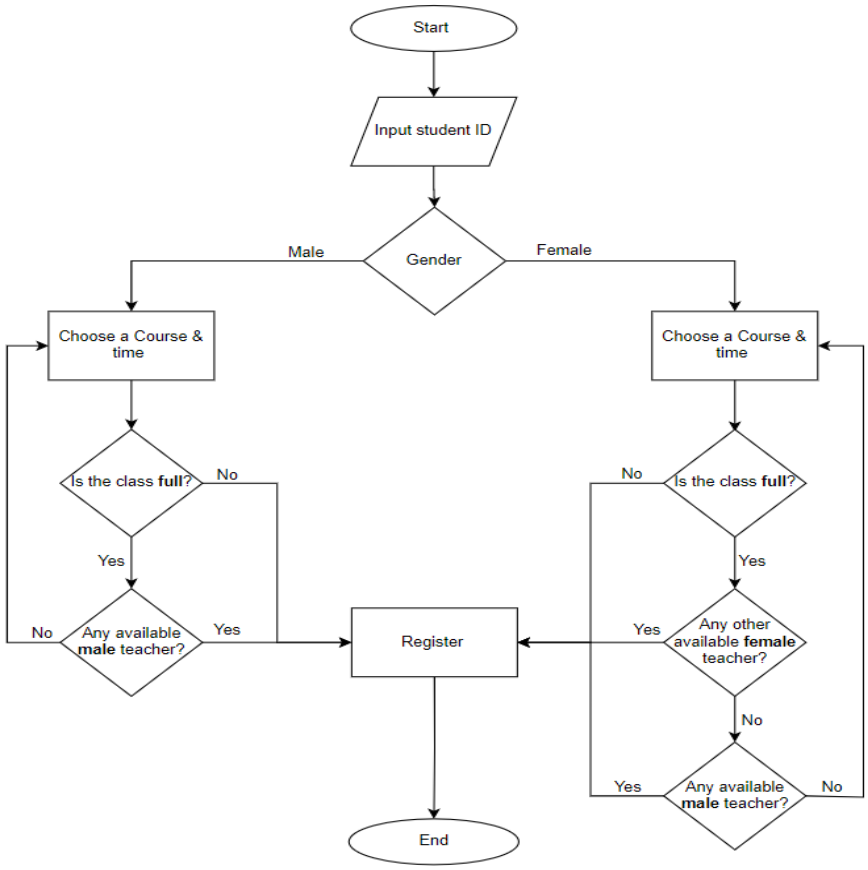


Figure 4. Class registration-student portal

### 3.4. Manage chat

Chat plays a crucial role in fostering collaborative learning within the educational platform; illustrating the chat feature plays an essential role in promoting collaborative learning within the educational platform and illustrating interactions among group members, including the lecturer. In Figure 5, the system differentiates between lecturers and group members. Group members, as students, can access the chat interface seamlessly, while lecturers need to select the corresponding group first. Once inside, users, including the lecturer, can engage in text-based or video conversations. Authorization for chat functions is uniform for all users sharing the group, enabling actions such as accessing text-based chat, viewing chat members, participating in discussions, adding or deleting chats, muting notifications, and viewing announcement wall news.

Conversely, initiating video conversations involves entering "private video chat" and choosing users from the list, as illustrated in Figure 6. In the context of exploring gender-related considerations in the chat, it is crucial to emphasize that students can only access courses they are enrolled in, and the homepage varies based on gender. For instance, male students and lecturers cannot access female-specific rooms unless granted authorization as lecturers. Figure 6 displays the interface, featuring solely the "room's member list" on the left side, comprising only the male class members. Additionally, during the video chat, participation is limited to the male members of that specific room.

## 4. PROTOTYPE EVALUATION

User satisfaction in software system evaluation is a significant aspect [35]. The prototype's primary aim is to validate the proposed model through real-world assessment, checking alignment with the prototype. Efficient identification of critical errors in a new user interface design prototype typically requires a sample size of 3 to 20 participants [35]. Purposive sampling, recommended by [36], involved recruiting twenty practitioners, including heads of educational technology, e-learning specialists, senior academics, and five higher education students. Google forms facilitated the quantitative evaluation questionnaire, validated through a preliminary test by two academics to ensure measurement consistency [35]. The questionnaire, with three ratings and two open-ended questions, employed a 5-point Likert scale. Participants received an

explanation of the prototype concepts and accessed the prototype via a hosted webpage through WhatsApp after approval. Survey results indicate intense satisfaction with the prototype's user-friendliness (90% agreement) and its potential to encourage adoption (80% agreement). Participants highlighted customization options and multilingual support for cultural inclusivity while suggesting minor improvements like enhanced device compatibility and menu navigation efficiency. Overall, respondents expressed positive sentiments with a few minor comments about refinement.

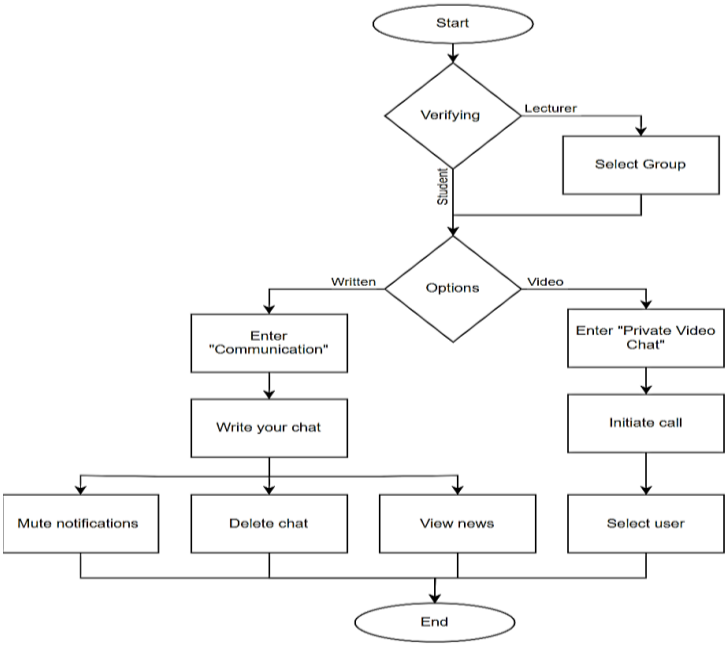


Figure 5. Manage chat and room members

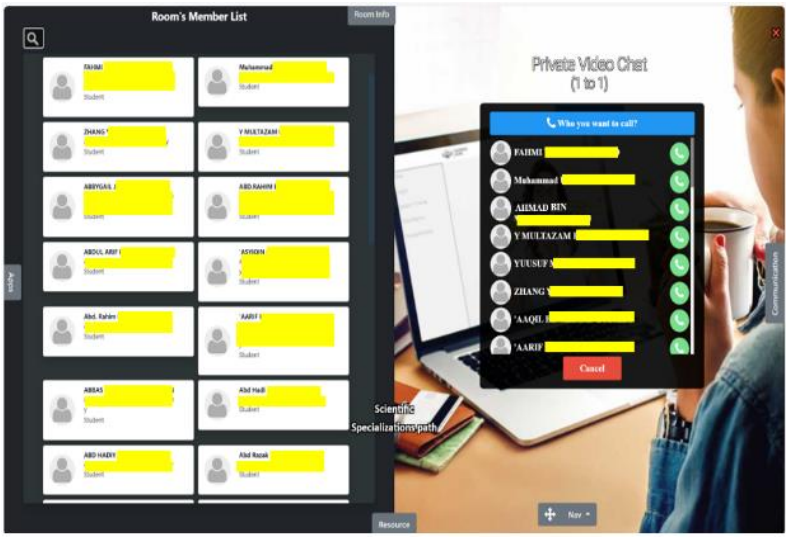


Figure 6. Manage chat and room members - gender

## 5. CONCLUSION

In conclusion, this paper explored the intricate cultural influences developed countries face, explicitly focusing on navigating language diversity and gender dynamics. Developing a culturally inclusive prototype emerged as a strategic response to these challenges within the Saudi educational landscape. Utilizing SA as a representative case study, our prototype design exemplifies the integration of cultural considerations deeply rooted in the county's Islamic traditions and societal norms. The proposed prototype

accommodates linguistic preferences and addresses gender-related concerns by actively involving diverse stakeholders and incorporating their perspectives. It aligns with the unique cultural and religious values prevalent in Saudi society. The synthesis of cultural inclusivity with cutting-edge prototype design aims to contribute to a forward-thinking and equitable education system that celebrates SA's rich cultural tapestry. As we navigate the complexities of these cultural influences, this work serves as a practical illustration, inspiring further innovation and culturally responsive approaches to technological development in education within the Saudi context and beyond. As we navigate the complexities of cultural influences, this work is a practical illustration, inspiring further innovation for technological development in education. Researchers hope this approach fosters inclusivity and sensitivity in educational practices, benefiting both developed and developing nations. Future research should focus on expanding the proposed framework to other regions with diverse cultural contexts, further refining the prototyping approach through real-world implementations and evaluations. Additionally, longitudinal studies assessing the long-term impact of being culturally inclusive on student engagement, learning outcomes, and institutional success would provide valuable insights. Continuous stakeholder feedback loops and iterative improvements will be crucial in ensuring the framework's relevance and effectiveness in an ever-evolving educational landscape.

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