

Ecological perspectives on virtual community engagement among university students during and after COVID-19



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ARTICLE INFO

Article history:

Received 26 July 2023

Received in revised form

13 November 2023

Accepted 25 November 2023

Keywords:

Virtual communities

Ecological perspective

Student engagement

COVID-19

Digital interaction

ABSTRACT

This research, conducted at Hail University, explores how university students interact with online communities during and after the COVID-19 pandemic using an ecological perspective. It aims to understand the increased role of these platforms in education and socialization during the pandemic. The study focuses on examining students' views, activities, and motivations in online interactions. A detailed electronic questionnaire was used to investigate students' understanding, use, and application of online communities. It also looked at ecological methods to improve involvement, such as increasing awareness, assessing risks, providing support, and tackling challenges in online communities. Various methods, including content analysis, surveys, case studies, and detailed interviews, were used to test these approaches. The results show that students frequently use online communities, with no significant differences in use based on gender, field of study, or academic level. The research highlights the importance for educational institutions to adopt these findings and methods to create an effective online community environment that supports students' overall growth and academic success. This study is unique in its ecological approach and offers new insights into student engagement in virtual communities.

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1. Introduction

Modern technology has ushered in a new era of communication and social interaction among members of society, providing them with a virtual community that facilitates the exchange of different opinions, ideas, and knowledge. The Internet, as one of the latest communication technologies of the past two decades, can bring about radical changes in the concepts of space and time on a global scale. It affords users the freedom to select communication services that align with their needs and ensure their satisfaction (Aristovnik et al., 2020; Romm et al., 1997). Virtual communities have significantly evolved in their structure, functions, and features,

displaying new patterns of more interactive tools. These communities attract numerous users due to the knowledge and skills they offer. Initially, their use centered on individual relationships between the user and the network and the sharing of information. However, more advanced generations have emerged, promoting a transition from an individual framework of network interaction to electronic social participation (Zhao and Shi, 2022).

In the modern digital age, virtual communities have become an integral part of social interactions and information sharing. These online platforms allow individuals to connect, collaborate, and form communities with shared interests, transcending geographical limitations. Amidst the unprecedented challenges posed by the COVID-19 pandemic, virtual communities have assumed a prominent role, particularly for university students. As physical distancing measures and lockdowns forced educational institutions to transition to remote learning, university students increasingly relied on virtual communities to maintain social connections,

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<https://doi.org/10.21833/ijaas.2023.12.011>

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access academic resources, and cope with the emotional strains of isolation.

Understanding the dynamics of virtual community usage and its consequences for university students in the context of the COVID-19 pandemic is essential to addressing the broader implications of this societal shift and devising effective strategies to support students' holistic development during these turbulent times. This study takes an ecological perspective, aiming to examine the multifaceted aspects of virtual communities and their impact on university students at Hail University, Saudi Arabia (Strassmann, 1997)

The origins of virtual communities can be traced back to the early days of computer-mediated communication. In the 1980s and 1990s, bulletin board systems (BBS) and internet forums provided the first instances of virtual community formation, where users could interact and share information on specific topics of interest.

The early 2000s saw the emergence of social networking sites like Friendster and MySpace, which further popularized virtual communities by enabling individuals to create profiles, connect with friends, and join interest-based groups. However, it was the launch of Facebook in 2004 that marked a significant turning point, propelling social media into mainstream culture and fostering the rapid growth of virtual communities (Zhao and Shi, 2022).

The significance of studying virtual communities in recent years cannot be overstated. As technology continues to reshape how people communicate and interact, virtual communities have become powerful platforms that influence various aspects of individuals' lives. These digital spaces have facilitated knowledge sharing, mobilized social movements, and transformed the dynamics of social engagement. Additionally, virtual communities have provided vital support systems and resources for individuals facing common challenges, fostering a sense of belonging and connectivity in an increasingly globalized world.

In the context of the COVID-19 pandemic, virtual communities emerged as essential lifelines for university students, compensating for the loss of face-to-face interactions and traditional campus experiences. These platforms have not only facilitated academic continuity but also offered emotional support, combating feelings of isolation and uncertainty during the pandemic (Zhao and Shi, 2022).

The rapid growth and evolution of virtual communities have sparked a growing interest among researchers, educators, policymakers, and the public alike. Scholars recognize the need to comprehend the various dimensions of virtual community engagement and its potential implications for the well-being and academic performance of university students (Giddens et al., 2012).

Amidst concerns about screen time, mental health, and the long-term consequences of virtual community reliance, there is a pressing need for evidence-based research to inform the development

of guidelines and interventions. The COVID-19 pandemic has amplified this urgency as the impact of widespread virtual community usage on university students has become more pronounced (Davis and Dunn, 2023).

This study is justified by the unique opportunity to gain insights into the real-world implications of virtual community usage for university students amid an ongoing global crisis. The COVID-19 pandemic has provided an unprecedented context in which to examine the interplay between virtual communities and students' academic, social, and emotional experiences.

By adopting an ecological perspective, this research aims to explore the complex interactions between individuals, technology, institutions, and society. The findings of this study will contribute to the academic literature on virtual communities, provide guidance to educational institutions in optimizing online learning experiences, and offer practical recommendations to support university students' overall well-being in an increasingly virtual world.

In conclusion, the study of the reality of virtual communities and their usage and repercussions on university students, particularly in the context of the COVID-19 pandemic, holds significant importance. The exploration of this topic from an ecological perspective offers a holistic understanding of the multifaceted impact of virtual communities on students' lives and will pave the way for informed decisions and tailored interventions to ensure the well-being and success of university students at Hail University (Abbas et al., 2019).

In conclusion, the research gap in the current study identifies areas that previous studies have not thoroughly explored, particularly in the context of Hail University students' experiences during and after the COVID-19 pandemic. This investigation zeroes in on how these students navigated virtual communities amidst the pandemic, emphasizing an ecological viewpoint that goes beyond the immediate academic and social impacts. The research introduces strategies grounded in this ecological framework to enhance student participation in these virtual spaces, addressing concerns like increasing awareness, evaluating potential risks, and overcoming challenges presented by these platforms. Given the unique circumstances of the pandemic, the study offers a deeper insight into the complexities of virtual community engagement, highlighting concerns such as increased screen time and its potential mental health implications. Furthermore, this research sheds light on the nuanced interplay between individual students, technological tools, institutional guidelines, and societal norms at Hail University, aiming to provide a roadmap for educational stakeholders to optimize online support and learning in a post-COVID digital era.

The emergence of communication technology, particularly the Internet, has revolutionized how individuals interact, leading to the formation of

virtual communities. These platforms have become integral aspects of social life, especially among university students, who utilize them for both educational and recreational purposes. Nevertheless, the use of these virtual communities raises concerns, especially regarding their potential impacts on students' identities, motivations, and overall behavior (Masrom et al., 2021).

The COVID-19 pandemic, which necessitated the transition to virtual learning, exacerbated these concerns. The significant surge in online activity raised questions about the implications of virtual communities for students' academic performance, social relationships, emotional well-being, and the development of personal values. Specifically, researchers have noted a decline in task performance and academic achievement among students at Hail University, which may be linked to their use of virtual communities. This issue is particularly pressing due to the pandemic, which has brought about an unprecedented reliance on virtual platforms for learning and social interaction (Abbas et al., 2019).

From an ecological perspective, the widespread use of virtual communities may be reshaping university students' environments, potentially influencing their behavior and development. While these communities can offer valuable resources for learning and self-development, their inappropriate use may also have adverse consequences. Hence, there is a critical need to understand the actual usage of virtual communities by university students and their impact on their academic, social, and personal lives.

The world is currently undergoing rapid changes in various areas of human life, including communication technology, notably the Internet. This shift has resulted in a significant transformation in how social life is established, shaping the social fabric that constructs relationships. Literature indicates that university students tend to utilize social media and other social platforms for educational and social purposes. They also employ these communities for entertainment by sharing music, images, and videos (Chukwuere, 2021).

An exploration was conducted into the impact of virtual websites on identity and the motives for their use by students. The study found that many users adopted pseudonyms and anonymous names while using these platforms. It was also suggested that parental monitoring of children's activities on these websites could help reduce their potential negative impacts (Chen and Kent, 2020). Another study confirmed the significant traits and factors that contribute to establishing virtual relationships (Koike et al., 2023). This research relied on a social survey and a questionnaire administered to a sample of individuals. The findings indicated that relatives were the primary category with whom respondents communicated through virtual relationships. The primary purpose of establishing these relationships was to pass the time and forge new connections. Most respondents emphasized that these virtual

relationships were not bound by societal norms, traditions, or censorship (Radwan, 2022).

An introduction to the concept of the virtual community and some aspects of virtual identity was made using a digital questionnaire. The findings supported people's desire for self-validation by showing that dialogue and idea exchange were the main drivers of engagement in virtual communities. The virtual identities of most participants mirrored their real-world identities, as evident by their statements reflecting their actual age and gender data. The state of the virtual community in family life, particularly after the surge in internet use by children of all ages, was also examined. This research revealed the most significant positive and negative moral and social changes that emerged in children's behavior due to their use of the Internet and participation in virtual communities. The research found that young people aged 16–35 were the most frequent Internet users. Their main motivations included the need for social communication, emotional support, self-expression, the exchange of views, and forming friendships.

In conclusion, this study aims to explore the diverse impacts of virtual communities on individuals, families, and societies, encompassing moral, religious, educational, literary, psychosocial, and emotional aspects. The research highlights that social networking sites and virtual communities may not be inherently negative, but their excessive use could potentially overshadow education and intellectual growth. The study observed a decline in task performance and academic achievement among students at the University of Hail, possibly due to a lack of understanding or awareness of their virtual community engagement. Considering how important multi-source environments are for learning and personal growth and how often social networks are used in university education, this study uses an ecological perspective to look at how students really use virtual communities and how they affect them, especially in the context of the pandemic. The objectives of this study are as follows:

1. Determining the reality of using virtual communities among Hail University students considering the Corona pandemic from an ecological perspective
2. Investigating the mechanisms used in virtual communities among Hail University students considering the Corona pandemic from an ecological perspective.
3. Investigating statistical differences among the research sample regarding their identification of the reality of using virtual communities according to the demographic variables: gender, specialization, and academic level

2. Methodology

This study adopts a descriptive research style, which involves the collection of facts, their analysis,

interpretation, and the drawing of conclusions. The primary aim is to investigate the usage of virtual communities among students at Hail University from an ecological perspective during the COVID-19 pandemic. To achieve this, the research employed the social survey method with a convenience sample comprising 106 students from Hail University for the academic year 2021–2022. By using this approach, the research successfully attained its objectives by gathering primary data through the main study tool, which entailed the identification and approval of an accessible sample of 106 participants handpicked by the researcher.

During the coronavirus crisis, the study faced difficulties in directly communicating with students. This led the researcher to opt for a convenience sampling method. Out of all the questionnaires gathered, only 106 were considered appropriate for statistical analysis. The challenges the pandemic presents and the safety guidelines set by the Saudi authorities are to blame for the small number, though some may consider it insufficient. Only fully completed questionnaires were analyzed, discarding any incomplete ones.

The research scopes can be summarized as follows:

1. Subjective Boundaries: The research deals with the study of the reality of virtual communities' use and its reflections on university students amidst the Corona pandemic, an analytical vision from an ecological perspective (University of Hail as a model).
2. Spatial Boundaries: The spatial scope of the research is at the University of Hail in Saudi Arabia.
3. Human Boundaries: The 106 students enrolled at the University of Hail for the academic year 2021–2022 represent the human scope of the research.
4. Time Boundaries: This research was conducted from September 1, 2022, to November 30, 2022.

The nature of our research objectives, the specific context of Hail University students during the pandemic, and the ecological perspective we aimed to emphasize all influenced our methodology choices. We believe that this approach provides a holistic and accurate representation of the topic under study, and we hope this clarification further strengthens the credibility of our research approach.

The data collection tools consisted of: The researchers developed an electronic questionnaire tailored for Hail University students to evaluate the actual usage of virtual communities during the COVID-19 pandemic. The questionnaire was designed using Google Drive models, drawing inspiration from relevant theoretical foundations and prior studies relevant to the research topic.

The questionnaire was structured around three primary dimensions, with each dimension containing a set of statements. However, the specific number of statements per dimension was not provided in the text.

To ensure comprehensiveness, each dimension consisted of 30 carefully formulated statements. These statements were then distributed to the participants for their responses. The questionnaire aimed to capture valuable insights into the students' experiences and perspectives regarding their engagement with virtual communities amid the COVID-19 pandemic.

The data were analyzed using the Statistical Package for the Social Sciences program (SPSS, Version 24.0). The following statistical methods were applied: frequencies, percentages, mean score, standard deviation, range, Cronbach's alpha coefficient for stability assessment, Pearson correlation coefficient, independent sample t-test, and one-way analysis of variance.

The content validity and reliability of the research instrument were meticulously addressed to ensure its accuracy, relevance, and consistency. The validity of the study was established through a multi-faceted approach incorporating expert evaluations and an extensive review of existing literature. This process led to the refinement of the questionnaire, ensuring that each phrase was both linguistically accurate and relevant to the research dimensions. The reliability was further emphasized by the strong internal consistency among the questionnaire dimensions. This rigorous process, combined with the careful presentation of data, underscores the instrument's credibility and its potential to yield meaningful insights into students' interactions with virtual communities.

The significance of this study can be derived as follows:

1. By examining the use of virtual communities at Hail University, one of the institutions contributing to human development, the research aims to shed light on the practical applications and challenges of integrating virtual platforms in an educational setting.
2. The study's findings may serve as a valuable source of information for educators, administrators, and policymakers, providing insights into the effectiveness and impact of virtual communities in supporting learning and social interactions at the university level.
3. Through an ecological perspective, the research delves into the multifaceted aspects of virtual community usage, considering how individual, social, and institutional factors influence the adoption and implementation of virtual platforms.
4. The focus on Hail University as an exemplar provides a specific and detailed case study that can offer nuanced observations and lessons applicable to other educational institutions facing similar circumstances.
5. This research holds significance for advancing the understanding of virtual communities' roles and impacts in higher education, paving the way for further exploration and potential improvements in pedagogical practices and student engagement.

The hypotheses of this study can be mentioned as follows:

1. There are no statistically significant differences at the level of significance ($0.05 \leq \alpha$) between the mean score of the research sample regarding their determination of the reality of using virtual communities according to gender.
2. There are no statistically significant differences at the level of significance ($0.05 \leq \alpha$) between the mean score of the research sample regarding their determination of the reality of using virtual communities according to specialization.
3. There are no statistically significant differences at the level of significance ($0.05 \leq \alpha$) between the mean score of the research sample regarding their identification of the reality of using virtual communities, according to academics.

Regarding hypothesis formulation, our study aims to understand virtual community usage across diverse student groups holistically. The hypotheses were crafted considering factors like gender, specialization, and academic level, which often influence technology engagement in educational contexts. The chosen significance level of 0.05, a standard in educational and social sciences, ensures a balance between statistical rigor and practical relevance. These methodological choices are meticulously aligned with the research objectives to provide comprehensive insights into virtual community engagement among our study's participants.

2.1. Definition of key terms

2.1.1. Virtual communities

Virtual communities refer to social groups or networks that primarily interact and communicate through online platforms or digital channels. These communities are characterized by shared interests, goals, or activities, bringing together individuals from diverse geographical locations in a virtual environment.

Usage: In the context of this research, usage pertains to the extent and frequency of engagement, participation, and interaction within virtual communities among university students. It involves how students employ digital tools and platforms to connect, collaborate, and communicate with peers and others online.

Repercussions: Repercussions refer to the consequences or effects resulting from the utilization of virtual communities on university students' academic, social, and psychological well-being. These effects could include changes in learning outcomes, social relationships, emotional experiences, and overall satisfaction with virtual community participation.

University Students: University students are individuals enrolled in higher education institutions pursuing undergraduate or postgraduate degrees.

For this research, the focus is specifically on students studying at Hail University, an exemplary institution chosen for in-depth analysis (Zhao and Shi, 2022).

2.1.2. COVID-19 pandemic

The COVID-19 pandemic refers to the global outbreak of the coronavirus disease (COVID-19) caused by the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). The pandemic, declared in early 2020, led to widespread health concerns and mandated significant changes in various aspects of life, including education.

Ecological Perspective: The ecological perspective, in the context of this research, is a theoretical framework that examines virtual community usage and its repercussions within a broader context of interconnected systems and influences. It considers the interplay between individual, social, institutional, and environmental factors shaping the experiences and outcomes of virtual community engagement among university students. An Exemplar from Hail University: An exemplar refers to a representative or illustrative example used in research to provide an in-depth examination of a specific case or context. In this study, Hail University serves as the exemplar, and the research focuses on its students' experiences with virtual communities during the COVID-19 pandemic. The above definitions of key terms aim to provide clarity and contextual understanding of the core concepts central to the research paper titled "The Reality of Virtual Communities: Usage and Repercussions on University Students in Light of the COVID-19 Pandemic: An Ecological Perspective. An Exemplar from Hail University." These definitions are presented in APA style, offering a comprehensive overview for readers to grasp the fundamental terminology and concepts used throughout the research of Filindassi et al. (2022).

2.1.3. Digital platforms

Virtual communities thrive on various digital platforms, such as social media networks, online forums, chat rooms, and specialized websites. These platforms facilitate communication, content sharing, and collaboration among community members. (Lokhtina et al., 2022).

2.1.4. Member interaction

Interaction within virtual communities can take various forms, including text-based conversations, multimedia sharing, video conferencing, and online events. Members can exchange ideas, seek advice, offer support, and engage in meaningful discussions.

2.1.5. Ecological perspective

The ecological perspective is a widely utilized theoretical framework in disciplines like psychology,

sociology, and education. It helps to comprehend human behavior, interactions, and experiences within the context of their environment and social systems. This perspective acknowledges the interconnectedness of various systems influencing individuals, ranging from family and peers to cultural norms and societal structures.

In the research paper titled "The Reality of Virtual Communities: Usage and Repercussions on University Students in Light of the COVID-19 Pandemic: An Ecological Perspective, An Exemplar from Hail University," the ecological perspective is applied to investigate the impact of virtual community usage on university students during the COVID-19 pandemic.

Key factors considered within the ecological perspective concerning virtual community usage among university students include:

1. Individual Factors: Acknowledging that each student possesses unique characteristics, attitudes, and beliefs that influence their engagement with virtual communities' Personal traits, learning styles, and prior experiences with technology may affect their usage patterns.
2. Social Factors: Social factors have an impact on the interactions and relationships within virtual communities. Peer support, group dynamics, and social norms can affect how students participate and communicate within these online networks.
3. Institutional Factors: The policies, practices, and resources provided by educational institutions, such as Hail University, play a role in shaping virtual community usage. The availability of technological infrastructure, online learning platforms, and institutional support may impact students' experiences.
4. Technological Factors: The characteristics and functionalities of the virtual community platforms themselves can influence students' engagement and the types of interactions facilitated by these platforms.

Cultural and societal factors: cultural norms, values, and societal expectations can shape students' perceptions of virtual community usage and influence the extent to which they utilize these

platforms for academic and social purposes (Gong and Liu, 2018).

3. Results and discussion

In the context of the research, Table 1 serves as a valuable tool for assessing the use of virtual communities among Hail University students during the Corona pandemic. Table 1 presents three main dimensions, each with its corresponding sub-dimensions, and the total number of phrases in each category.

The first dimension, "understanding of virtual communities," is crucial in evaluating the students' grasp and knowledge of virtual communities. It contains ten phrases (numbered from 1 to 10) that aim to capture the depth of their comprehension.

The second dimension, "realization of virtual communities," delves into the students' perception and awareness of the significance and impact of virtual communities in their academic lives. It comprises ten phrases (numbered from 11 to 20) that assess the students' realization of the virtual community's role during the pandemic.

The third dimension, "virtual community application," explores the practical application and utilization of virtual communities in their educational experiences and interactions. This dimension contains ten phrases (numbered from 21 to 30) that probe the extent to which students engage with virtual platforms in various aspects of their academic journey.

By using this structured questionnaire, the research team aims to gain insights into how Hail University students perceive, understand, and apply virtual communities during the challenging circumstances brought on by the Corona pandemic. The well-organized Table 1 ensures that each dimension and sub-dimension is accounted for, facilitating a comprehensive evaluation of the student's attitudes and behaviors toward virtual communities. This information will be invaluable in informing future strategies and interventions to enhance the students' virtual community engagement and overall academic experience during these unprecedented times.

Table 1: Students' questionnaire phrase disturbances

Main dimensions	Sub-dimensions	Sum of phrases	No. of phrases
The use of virtual communities among Hail University students considering the Corona pandemic	Understanding of virtual communities	10	1 - 10
	Realization of virtual communities	10	11-20
	Virtual community application	10	21-30

Table 1 details the organization and allocation of phrases within a questionnaire aimed at gauging Hail University students' engagement with virtual communities during the Corona pandemic. Table 1 is segmented into four columns, highlighting the main dimension of the questionnaire, three sub-dimensions (understanding, realization, and application of virtual communities), the total number of phrases for each sub-dimension, and their respective numbering. Each sub-dimension contains

ten specific phrases, cumulatively totaling 30. The phrases are sequentially numbered, indicating the structure and flow of the questionnaire, ensuring a comprehensive assessment of students' interactions with virtual platforms during the pandemic.

The students' questionnaire was on a five-point scale, and responses were: strongly agree, agree, neutral, disagree, and strongly disagree. Each of these responses was given a weight (score), as shown in Table 2.

Table 2: Student questionnaire scores

Responses	Strongly agree	Agree	Neutral	Not agree	Strongly not agree
Phrase	5	4	3	2	1

This study examined how much Hail University students use virtual communities during the COVID-19 pandemic. To do this, a scale with five categories was used. These categories were: 'strongly agree' (rated as 5), 'agree' (rated as 4), 'neutral' (rated as 3), 'disagree' (rated as 2), and 'strongly disagree' (rated as 1). To find the range of each of the five sections of the scale, the difference between the

highest (5) and lowest (1) values was calculated, resulting in 4. This number was then divided by the number of scale categories (5) to find the corrected length of each category, which was 0.8. This value was added to the lowest value of the scale, which is 1, to find the upper limit of each category. Therefore, the length of each category was established (Table 3).

Table 3: Levels of mean score for the dimensions of the research

Level	Score
Very low	The mean value of the phrase or dimension ranges from 1 to less than 1.8
Low level	The mean value of the phrase or dimension ranges from 1.8 to less than 2.6
Average level	The mean value of the phrase or dimension ranges from 2.6 to less than 3.4
High level	The mean value of the phrase or dimension ranges from 3.4 to less than 4.2
very high level	The mean value of the phrase or dimension ranges from 4.2 to less than 5

3.1. Validity and reliability

3.1.1. Content validity

The validity of the instrument was determined by seeking feedback from a panel of 12 experts and specialists. Their input was essential for confirming the clarity and precision of the questionnaire's wording, as well as ensuring alignment of each statement with its intended purpose. The questionnaire is segmented into four distinct sections. The inaugural section focuses on general information, while the subsequent trio of sections comprises statements directly linked to the research hypotheses. In the quest to authenticate the content validity of this instrument, the researchers embarked on two pivotal steps:

1. Literature Review: An exhaustive examination of existing literature and pertinent theoretical frameworks was undertaken, which facilitated the identification of appropriate dimensions and phrasing to be incorporated into the research questionnaire.

2. Expert Review: The draft questionnaire was subsequently shared with five seasoned professionals from the Faculty of Social Work at Helwan University. Their expertise was leveraged to gauge the linguistic precision of the statements and their pertinence to the research dimensions. Their invaluable feedback led to the revision, modification, or removal of certain phrases.

This meticulous approach culminated in the refinement and finalization of the instrument in its current iteration.

3.1.2. Content of reliability

Content of reliability and ensuring that the information regarding the significant correlation from Table 4 is well-structured and appropriately presented. Moreover, the number of students in the separate sample for assessing reliability is now correctly preceded by the letter "n" to signify the sample size.

Table 5 shows that the reliability coefficients for the dimensions of the instrument were high, and thus, the questionnaire's results can be relied upon.

Table 4: Internal consistency between student questionnaire dimensions and the total instrument score (n=20)

No.	Dimensions	Correlation coefficient	Sig
1	Understanding of virtual communities	.915	**
2	Perception of virtual communities	.834	**
3	Application of virtual communities	.936	**

** Significant at 0.01

Table 5: Results of the reliability of the students' questionnaire using the reliability coefficient (n=20)

No.	Dimensions	Reliability coefficient (Cronbach's alpha)
1	Understanding of virtual communities	0.92
2	Perception of virtual communities	0.89
3	Application of virtual communities	0.91
	Total reliability of students' questionnaire	0.93

3.2. Description of students at the University of Hail

The results presented in Table 6 provide a detailed overview of the student population at Hail University:

- The average age of students at Hail University was 22 years old, with a standard deviation of approximately two years.
- Among the students at the University of Hail, the majority were female, accounting for 58.5%, while males represented 41.5% of the total.

- According to the distribution of majors among students at the University of Hail, the humanities accounted for the highest percentage (48.1%), with scientific and engineering majors coming in second at 34% and health majors coming in third at 17.9%.
- The distribution of students across academic levels showed that the first level had the highest percentage (25.5%), then the seventh level with a rate of 19.8%, and the sixth level with a rate of 5.7%.
- In terms of electronic device usage among students, the most used device was mobile phones, with 87.7% of the students utilizing them. iPads came in second place with 19.8% of the vote, behind laptops at 31.1%.
- When it comes to electronic applications, Blackboard ranked as the top choice, with 84% of students using it. 17% of students used Twitter, and WhatsApp was the second-most popular app with 51.9% of the user base.

Table 6: A comprehensive description of the students enrolled at the University of Hail (n=106)

Quantitative variables	M	SD
Age	22	2
Gender	Frequency	%
Male	44	41.5
Female	62	58.5
Total	106	100
Specialization	Frequency	%
Humanitarian specialty	51	48.1
Health specialty	19	17.9
Scientific & engineering specialty	36	34
Total	106	100
Academic Level	Frequency	%
First Level	27	25.5
Second Level	9	8.5
Third Level	8	7.5
Fourth Level	7	6.6
Fifth Level	15	14.2
Sixth Level	6	5.7
Seventh Level	21	19.8
Eighth Level	13	12.3
Total	106	100
electronic devices	Frequency	%
laptop	33	31.1
cell phone	93	87.7
IPAD	21	19.8
Electronic apps	Frequency	%
Blackboard	89	84
WhatsApp	55	51.9
U tube	32	30.2
Snapchat	25	23.6
Twitter	18	17

3.3. Hail University students' virtual community engagement during the COVID-19 pandemic

The results from [Table 7](#) indicate that the total dimensions of using virtual communities among Hail University students during the COVID-19 pandemic were high, with a total mean score of 3.84. "Understanding of virtual communities" came in first

place among the dimensions with a mean score of 3.9, then "application of virtual communities" came in second place with a mean score of 3.85, and finally, "perception of virtual communities" came in third place with a mean score of 3.78.

This positive outcome can be attributed to the rapid and successive development of information and communication technology, which has facilitated increased social interaction among members of society, particularly among Hail University students engaging in virtual communities. Notably, platforms like Blackboard, WhatsApp, and Twitter have played crucial roles in supporting students' educational communication during the pandemic.

These findings are consistent with a study by [Bamoallem and Altarteer \(2022\)](#), which highlighted how well-prepared students were for distance learning and how they had adapted to the crisis. The preference for asynchronous interaction methods was evident. However, the study also revealed that the level of interaction varied between academic levels and majors, with some students facing challenges accessing the university platform due to the need for additional support. Material and human obstacles were identified as limiting factors hindering students' full engagement with available activities. Similarly, [Dray et al. \(2011\)](#) found a positive effect of distance education in schools during the COVID-19 crisis, particularly in Qasaba Irbid, without significant differences attributed to the gender variable.

3.4. Testing research hypotheses

3.4.1. Testing the first hypothesis

The first hypothesis of the research examines whether there are statistically significant differences, at a significance level of $(0.05 \leq \alpha)$, between the mean scores of the research sample concerning their perception of using virtual communities based on gender.

Upon examination of the preceding [Table 8](#), the following findings come to light:

1. No significant discrepancies were detected at the 0.05 level of significance between the average scores of both male and female research participants in terms of gauging their understanding of virtual communities, along with their awareness and application levels.
2. There were also no significant differences at the 0.05 level of significance in the average scores between male and female participants concerning their evaluation of the total dimensions of utilizing virtual communities.

Table 7: Levels of total dimensions of virtual community usage during the COVID-19 pandemic

No.	Dimensions	M	SD	Level	Rank
1	Understanding of virtual communities	3.9	0.8	High	1
2	Perception of virtual communities	3.78	0.56	High	3
3	Application of virtual communities	3.85	0.8	High	2
	Total dimensions of virtual communities	3.84	0.56		High level

Table 8: Significant differences between the mean scores of male and female research samples regarding their perception of using virtual communities (n = 106)

No.	Dimensions	Sample	N	M	SD	df	T	Sig.
1	Understanding of virtual communities	Female	44	3.97	0.68	104	0.864	Non
		Male	62	3.84	.88			
2	Perception of virtual communities	Female	44	3.78	.56	104	-0.123	Non
		Male	62	3.79	.57			
3	Application of virtual communities	Female	44	3.8	.78	104	-0.489	Non
		Male	62	3.88	.82			
	Total dimensions of using virtual communities	Female	44	3.85	.53	104	.119	Non
		Male	62	3.84	.58			

This outcome is likely due to the negligible differences in mean scores between male and female students at the University of Hail in assessing their comprehension, perception, and implementation of virtual communities. The cause of this can be traced back to the nature and features of the non-direct virtual community, one of its key characteristics being a shared interest that disregards geographical, ethnic, political, or social boundaries. The primary objective is to foster interaction within this virtual environment as students establish amongst themselves the criteria for group membership, guidelines for joining or leaving, and strategies for handling this virtual environment, all in accordance with a pre-set agreement. In contrast, traditional educational classrooms necessitate gender segregation, which is commonplace in our Arab societies, adhering to prevailing customs and traditions.

This finding aligns with [Xia et al. \(2022\)](#), which advocated for universities to conduct seminars and lectures to caution the youth against the threats of incitement and extremism prevalent on YouTube channels and Twitter.

The research's first hypothesis, which posits "there are no statistically significant differences at the 0.05 level of significance between the average

scores of the research participants concerning their identification of the practical usage of virtual communities based on gender," is accepted.

3.4.2. Testing the second hypothesis

No significant differences at the 0.05 level exist in the mean scores of participants' actual use of virtual communities, varying by specialization.

The preceding [Table 9](#) reveals the following key findings:

1. There were no statistically significant differences, at the significance level of ($0.05 \leq a$), in the mean scores of the research sample across different specializations (humanitarian, health, scientific, and engineering) concerning their perception of virtual communities' understanding, perception, and application.
2. Similarly, no statistically significant differences, at the significance level of ($0.05 \leq a$), were observed in the mean scores of the research sample across different specializations (humanitarian, health, scientific, and engineering) concerning the total dimensions of virtual community usage.

Table 9: Analysis of variance for the utilization of virtual communities among hail university students based on specialization (n=106)

No.	Dimensions	Source of variance	Sum of squares	(df)	Mean of squares	F	Sig.
1	Understanding of virtual communities	Between groups	0.190	2	0.095	.146	Non
		Within groups	76.008	103	0.651		
		Total	67.198	105			
2	Perception of virtual communities	Between groups	0.648	2	0.324	1.027	Non
		Within groups	32.502	103	0.316		
		Total	33.149	105			
3	Application of virtual communities	Between groups	3.606	2	1.803	2.922	Non
		Within groups	63	103	0.617		
		Total	67.163	105			
	Total dimensions of using virtual communities	Between groups	0.939	2	0.470	1.514	Non
		Within groups	31.947	103	0.310		
		Total	32.886	105			

These results suggest that the students at Hail University, regardless of their fields of study (humanities, health sciences, or scientific and engineering disciplines), exhibit similar levels of understanding, perception, and application of virtual communities. This could be attributed to the shared background among both male and female students, contributing to stronger virtual relationships that foster virtual communities around specific topics, thinkers, scientists, or characters.

These results are consistent with a study by [Wang et al. \(2011\)](#) showed students' resilience in the face of adversity and their readiness for distance

learning while indicating a preference for asynchronous interaction and support. However, interaction levels varied across different academic majors due to certain material and human obstacles that hindered students' engagement with available activities.

As a result, the second hypothesis of the research stating that "There are no statistically significant differences at the level of significance ($0.05 \leq a$) between the mean score of the research sample regarding the reality of using virtual communities according to specialization," is confirmed ([Lokhtina et al., 2022](#)).

3.4.3. Testing the third hypothesis

hypothesis (3) was tested to determine if there are any statistically significant differences, at the significance level of $(0.05 \leq \alpha)$, between the mean scores of the research sample regarding their perception of using virtual communities based on their academic levels. Table 10 indicates the following key findings:

1. There were no statistically significant differences, at the significance level of $(0.05 \leq \alpha)$, in the mean

scores of the research sample across different academic levels (first level to eighth level) regarding their understanding, perception, and application of virtual communities.

2. Additionally, there were no statistically significant differences, at the significance level of $(0.05 \leq \alpha)$, in the mean scores of the research sample across different academic levels (first level to eighth level) regarding the total dimensions of virtual community usage.

Table 10: The analysis of variance for this aspect among Hail University students (n=106)

No.	Dimensions	Source of variance	Sum of squares	df	Mean of squares	F	Sig.
1	Understanding of virtual communities	Between groups	8.771	7	1.253	2.102	Non
		Within groups	58.428	98	0.596		
		Total	67.198	105			
2	Perception of virtual communities	Between groups	1.684	7	0.241	0.749	Non
		Within groups	31.466	98	0.321		
		Total	33.149	105			
3	Application of virtual communities	Between groups	5.475	7	0.782	1.242	Non
		Within groups	61.688	98	0.629		
		Total	67.163	105			
Total dimensions of using virtual communities		Between groups	4.133	7	.590	2.012	Non
		Within groups	28.753	98	.293		
		Total	32.886	105			

These results can be attributed to the negligible mean variations among the research sample based on their academic levels concerning the extent of their understanding, perception, and application of virtual communities. Factors such as the sense of community or group, support exchange, emotional attachment to group members, the ability to influence, and the impact of academic community dynamics might contribute to this uniformity.

This research supports the results (Sintema, 2020) that assessed the efficacy of e-learning during the COVID-19 pandemic. The study noted average results in several areas, including continuity of e-learning, obstacles encountered in utilizing e-learning, faculty members' engagement with e-learning, and students' interaction with e-learning. This further validated the third hypothesis of the research: "There are no statistically significant differences at the significance level of $0.05 \leq \alpha$ between the mean score of the research sample concerning their assessment of the reality of using virtual communities according to their academic level." The findings and interpretations of this study can be outlined as follows:

1. Most of the students at the University of Hail were female. The most used device for education was mobile phones, while iPads were the least utilized. Blackboard emerged as the most used electronic application for education, with Twitter being the least used.
2. There was a significant positive correlation between aspects of using virtual communities among university students during the COVID-19 pandemic. This correlation was observed in terms of students' understanding, perception, adaptation to, application of, and interaction with virtual communities, especially via Blackboard and

distance education. A significant statistical relationship was discovered between virtual community dimensions and their impact on students.

3. Of the dimensions of virtual communities, "understanding virtual communities" was the most prevalent among students at the University of Hail, with an average score of 3.9. In contrast, "perception of virtual communities" was the least prevalent dimension, scoring an average of 3.7. This could be attributed to the rapid advancements in information and communication technology.
4. No significant mean differences were found between male and female students at the University of Hail in terms of understanding, perception, and application of virtual communities.
5. Similarly, no differences were observed in the responses of students concerning the use of virtual communities based on their academic specialization or level.
6. The study used an ecological lens to examine how online communities affected college students during the COVID-19 pandemic. Virtual communities were viewed as open social systems that have both a positive and negative impact on society. These communities work to preserve balance during the epidemic and have inputs, a transformative process, outputs, roles, and feedback.
7. The study proposed mechanisms to stimulate the use of virtual communities among students at the University of Hail from an ecological perspective during the COVID-19 pandemic. These include fostering a sense of belonging, the ability to influence the virtual community through reactions,

offering support, fulfilling needs, emotional attachment, presence, attendance, and trust.

In conclusion, this research underscored the significance of virtual communities in the educational landscape during the COVID-19 pandemic, offering crucial insights into their usage and impact on university students at the University of Hail. The Results presented in this section align with the study's previously stated findings (Preece, 2000).

3.4.4. Testing the forth hypothesis

Hypothesis (4) proposed mechanisms to promote the utilization of virtual communities among hail university students during the COVID-19 pandemic from an ecological perspective.

The primary objective of proposing activation mechanisms for virtual communities among Hail University students is to encourage increased utilization of these platforms and maximize their benefits. This approach adopts an ecological perspective, focusing on understanding, perception, and effective utilization of virtual communities.

From an ecological point of view, the proposal identifies several important systems for activating virtual communities. These include the whole university system, students' access to and use of information technology, interactions between peers, students' use of social media platforms, and surveys done by activation mechanism teams (Porter, 2004).

Multiple tools are employed to verify the implementation of these mechanisms. These include the analysis of content from students' descriptive and statistical periodic reports through the university's IT system, surveys done by activation mechanism teams to track progress, case studies that focus on specific activation mechanisms, and interviews with people who oversee building virtual communities at Hail University (Yeung and Yau, 2022; Li and Li, 2015).

The suggested mechanisms for promoting virtual communities from an ecological perspective are diverse. They involve raising awareness among leaders and systems about the effective utilization of virtual communities while maintaining necessary controls. Additionally, they include evaluating the benefits and risks of virtual community usage with the assistance of technical support experts. Furthermore, these mechanisms entail assessing students' understanding and perception of virtual communities, providing support to students for their needs within these communities, enhancing leaders' perception and approach towards students' use of these platforms, and addressing potential risks associated with students' engagement in virtual communities (Cheung and Lee, 2009; Ito, 2013).

4. Conclusion

The study concludes that virtual communities played a significant role in supporting Ha'il

University students during the COVID-19 pandemic. The research utilized a structured questionnaire with three main dimensions: "understanding of virtual communities," "realization of virtual communities," and "virtual community application." The results indicated high levels of virtual community usage among students, with no significant gender-based differences in perception or utilization. Moreover, students from different academic disciplines displayed similar levels of engagement with virtual platforms. The research highlighted the importance of providing equal opportunities and support across specializations and emphasized the need for continuous monitoring and evaluation to enhance virtual community interactions. The study proposed activation mechanisms to stimulate virtual community usage, considering ecological perspectives such as fostering a sense of belonging, support, and emotional attachment within these communities. Overall, virtual communities emerged as a vital tool for distance education during unprecedented times, enabling students to adapt to online learning effectively. To ensure continued success, the study recommends implementing the proposed mechanisms, incorporating students' perceptions, understanding technological advancements, and developing programs to enrich their learning experiences through virtual communities.

4.1. Recommendations

1. Raise Virtual Community Awareness: Conduct awareness campaigns and workshops to highlight the benefits of virtual communities for learning and communication during challenging times.
2. Improve Virtual Community Platforms: Continuously assess and enhance virtual community platforms for better user experience and support.
3. Foster Inclusive Participation: Encourage active engagement and inclusivity within virtual communities, addressing potential barriers.
4. Tailor Engagement to Academic Majors: Customize virtual community strategies to meet the specific needs of different academic disciplines.

4.2. Study limitations and future directions

From an ecological point of view, if Hail University students want to be more involved in virtual communities, it is important to turn on the suggested mechanisms that encourage use and make application programs based on what students say they want. This will lead to more positive interactions and better learning experiences in virtual communities and distance education. Additionally, keeping pace with technological advancements and developing enhancement programs will enable students to leverage virtual communities for personal growth and improved family life. The impact of these efforts can be assessed through a case study to gauge effectiveness.

Moving forward, educational institutions should prioritize implementing these recommendations to foster a dynamic and supportive virtual community ecosystem, ensuring students' holistic development and academic success. Study limitations include a relatively small sample size, potential self-report bias, limited generalizability, and time constraints. Future research directions involve conducting longitudinal and comparative studies, incorporating qualitative approaches, examining international perspectives, exploring technological advancements, evaluating intervention programs, and addressing ethical considerations in virtual community usage.

In our study, we recognize the limitations, including a small and possibly non-representative sample size from Hail University, reliance on self-reported data, which can be influenced by biases, and the potential lack of generalizability due to our specific sample and time constraints. For future research, we recommend undertaking longitudinal studies to track changes, comparing experiences across different universities or countries, delving deeper using qualitative methods, studying the implications of technological advancements, evaluating specific interventions, and addressing ethical challenges, especially those related to privacy in virtual communities. Addressing these areas can significantly enhance the depth and applicability of future investigations in this field.

4.3. Study implications

The research highlights the significance of promoting and enhancing virtual community engagement among Ha'il University students during the COVID-19 pandemic. Findings indicate no significant gender-based differences in students' perception and usage of virtual communities, emphasizing the need for gender equality in accessing and utilizing these platforms. Additionally, students from diverse academic disciplines displayed similar levels of understanding and application of virtual communities, underscoring the importance of providing equal opportunities and support across specializations. To ensure continuous improvement, regular monitoring and evaluation of virtual community usage, along with the implementation of proposed activation mechanisms, are essential. Embracing technological advancements and adopting innovative approaches will optimize virtual community interactions and support distance education. A holistic approach, fostering a safe and supportive virtual environment, and building resilience are vital to preparing students for future disruptions to traditional learning models.

This study offers pivotal insights into optimizing virtual learning experiences for Hail University and comparable institutions. Key findings emphasize the need for gender equality in virtual resource access, consistent support across all academic domains, and the continuous updating and evaluation of virtual platforms. To bolster the virtual education

experience, Hail University should integrate the latest technological innovations, adopt a holistic approach addressing both technological and psychological student needs, and prepare contingency plans for potential future disruptions in traditional education. In essence, a proactive and comprehensive approach to virtual learning, informed by regular evaluations, will ensure a resilient and effective educational system.

Acknowledgment

This research has been funded by the Scientific Research Deanship at the University of Ha'il-Saudi Arabia through project number RG -20 198.

Compliance with ethical standards

Conflict of interest

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

References

- Abbas J, Aman J, Nurunnabi M, and Bano S (2019). The impact of social media on learning behavior for sustainable education: Evidence of students from selected universities in Pakistan. *Sustainability*, 11(6): 1683. <https://doi.org/10.3390/su11061683>
- Aristovnik A, Keržič D, Ravšelj D, Tomaževič N, and Umek L (2020). Impacts of the COVID-19 pandemic on life of higher education students: A global perspective. *Sustainability*, 12(20): 8438. <https://doi.org/10.3390/su12208438>
- Bamoallem B and Altarteer S (2022). Remote emergency learning during COVID-19 and its impact on university students perception of blended learning in KSA. *Education and Information Technologies*, 27(1): 157-179. <https://doi.org/10.1007/s10639-021-10660-7>
PMid:34276241 PMCID:PMC8275910
- Chen JC and Kent S (2020). Task engagement, learner motivation and avatar identities of struggling English language learners in the 3D virtual world. *System*, 88: 102168. <https://doi.org/10.1016/j.system.2019.102168>
- Cheung CM and Lee MK (2009). Understanding the sustainability of a virtual community: Model development and empirical test. *Journal of Information Science*, 35(3): 279-298. <https://doi.org/10.1177/0165551508099088>
- Chukwuere JE (2021). The impact of social media on students' social interaction. *Journal of Management Information and Decision Sciences*, 24(7): 1-15.
- Davis B and Dunn R (2023). Children's meaning making: Listening to encounters with complex aesthetic experience. *Education Sciences*, 13(1): 74. <https://doi.org/10.3390/educsci13010074>
- Dray BJ, Lowenthal PR, Miszkiewicz MJ, Ruiz-Primo MA, and Marczyński K (2011). Developing an instrument to assess student readiness for online learning: A validation study. *Distance Education*, 32(1): 29-47. <https://doi.org/10.1080/01587919.2011.565496>
- Filindassi V, Pedrini C, Sabadini C, Duradoni M, and Guazzini A (2022). Impact of COVID-19 first wave on psychological and psychosocial dimensions: A systematic review. *COVID*, 2(3): 273-340. <https://doi.org/10.3390/covid2030022>

- Giddens J, Hrabec D, Carlson-Sabelli L, Fogg L, North S (2012). The impact of a virtual community on student engagement and academic performance among baccalaureate nursing students. *Journal of Professional Nursing*, 28(5): 284–290. <https://doi.org/10.1016/j.profnurs.2012.04.011> **PMid:23006650**
- Gong H and Liu L (2018). Ecological discourse analysis of an UN environmental story in terms of transitivity process. *Advances in Language and Literary Studies*, 9(3): 67-77. <https://doi.org/10.7575/aiac.all.v.9n.3p.67>
- Ito M (2013). *Hanging out, messing around, and geeking out: Kids living and learning with new media*. The MIT Press, Cambridge, USA.
- Koike M, Loughnan S, and Stanton SC (2023). Virtually in love: The role of anthropomorphism in virtual romantic relationships. *British Journal of Social Psychology*, 62(1): 600-616. <https://doi.org/10.1111/bjso.12564> **PMid:35915868**
- Li Y, He X, and Hu D (2015). Information seeking and sharing in virtual communities: A case study of Chinese IT professionals. *Proceedings of the Association for Information Science and Technology*, 52(1): 1-10. <https://doi.org/10.1002/pr2.2015.145052010030>
- Lokhtina IA, Castelló M, Lambrechts AA, Löfström E, McGinn MK, Skakni I, and van der Weijden I (2022). The impact of the COVID-19 pandemic on early career researcher activity, development, career, and well-being: the state of the art. *Studies in Graduate and Postdoctoral Education*, 13(3): 245-265. <https://doi.org/10.1108/SGPE-10-2021-0076>
- Masrom MB, Busalim AH, Abuhassna H, and Mahmood NH (2021). Understanding students' behavior in online social networks: A systematic literature review. *International Journal of Educational Technology in Higher Education*, 18: 1-27. <https://doi.org/10.1186/s41239-021-00240-7>
- Porter CE (2004). A typology of virtual communities: A multi-disciplinary foundation for future research. *Journal of Computer-Mediated Communication*, 10(1): JCMC1011. <https://doi.org/10.1111/j.1083-6101.2004.tb00228.x>
- Preece J (2000). Online communities: Designing usability, supporting sociability. *Industrial Management and Data Systems*, 100(9): 459-460. <https://doi.org/10.1108/imds.2000.100.9.459.3>
- Radwan M (2022). Effect of social media usage on the cultural identity of rural people: A case study of Bamha village, Egypt. *Humanities and Social Sciences Communications*, 9(1): 1-14. <https://doi.org/10.1057/s41599-022-01268-4>
- Romm C, Pliskin N, and Clarke R (1997). Virtual communities and society: Toward an integrative three-phase model. *International Journal of Information Management*, 17(4): 261-270. [https://doi.org/10.1016/S0268-4012\(97\)00004-2](https://doi.org/10.1016/S0268-4012(97)00004-2)
- Sintema EJ (2020). Effect of COVID-19 on the performance of grade 12 students: Implications for STEM education. *EURASIA Journal of Mathematics, Science and Technology Education*, 16(7): em1851. <https://doi.org/10.29333/ejmste/7893>
- Strassmann PA (1997). Information systems and literacy. In: Hawisher GE and Selfe CL (Eds.), *Literacy, technology, and society: Confronting the issues*: 27-38. Routledge, Oxfordshire, UK.
- Wang Q, Chen W, and Liang Y (2011). The effects of social media on college students. *MBA Student Scholarship*, 5: 1–12.
- Xia Y, Hu Y, Wu C, Yang L, and Lei M (2022). Challenges of online learning amid the COVID-19: College students' perspective. *Frontiers in Psychology*, 13: 1037311. <https://doi.org/10.3389/fpsyg.2022.1037311> **PMid:36619114 PMCID:PMC9815150**
- Yeung MW and Yau AH (2022). A thematic analysis of higher education students' perceptions of online learning in Hong Kong under COVID-19: Challenges, strategies and support. *Education and Information Technologies*, 27: 181–208. <https://doi.org/10.1007/s10639-021-10656-3> **PMid:34421326 PMCID:PMC8364774**
- Zhao H and Shi Q (2022). Accessing the impact mechanism of sense of virtual community on user engagement. *Frontiers in Psychology*, 13: 9076. <https://doi.org/10.3389/fpsyg.2022.907606> **PMid:35783704 PMCID:PMC9240649**