Student's Priorities When Selecting Web Conferencing Tools in Sri Lankan Tertiary Education

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Abstract **- A properly selected web conferencing tool can significantly enhance student engagement, motivation, and learning outcomes in online education. Hence, this study aims to produce a framework ordering the key features and associated sub-factors of web conferencing tools that Sri Lankan tertiary sector students prioritize for their online learning experience. A quantitative research method is deployed to get the student's opinions on the factors discovered in a previous study on "Expert opinion on selecting a web conferencing tool for synchronous online tertiary education in Sri Lanka". The research hypothesis was tested using the Pearson Chi-square test, followed by exploratory and second-order factor analysis to rank the importance of sub-factors and main characteristics. The findings revealed that students prioritize collaboration features the most, followed by online event features, pricing, user-friendliness, customer support, security, online evaluation, performance, and screen-sharing. This framework offers valuable insights for Sri Lankan tertiary institutions to select web conferencing tools that truly align with student preferences. By incorporating these student-centric considerations, institutions can optimize the online learning experience, leading to improved engagement, learning outcomes, and ultimately, greater student satisfaction.**

Keywords **- Exploratory factor analysis, online education, second-order factor analysis, student opinion, web conferencing tools.**

DOI: 10.18421/TEM133-59
https://doi.org/10.18421/TEM133-59

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Received: 11 March 2024.
Revised: 02 July 2024.
Accepted: 14 August 2024.
Published: 27 August 2024.

1. Introduction

With the emergence of the COVID-19 pandemic, higher educational institutes globally are compelled to swap to online education. Even after the pandemic, the importance of online education continued to grow as the new normal [1]. With this worldwide transition, the use of web conferencing tools for educational purposes has also become increasingly common [2].

Web conferencing is any type of online meeting that involves two or more participants in different locations. With a reliable Internet connection and conferencing software, they can see, talk, and hear each other in real time [3]. A study by Zoysa *et al.* [4], has uncovered that there are about 143 web conferencing tools/software available in the market today. The study further revealed that Zoom, MS Teams, BigBlueButton, and Cisco Webex, are the popular web conferencing tools in the Sri Lankan tertiary education sector [4].

An ideal web conferencing tool enhances student engagement, motivation, and learning outcomes in online education [5]. Thus, it is significant to properly select a web conferencing tool that matches the needs of the desired student groups. However, there is a lack of research in the Sri Lankan context that discusses the features of web conferencing tools that the students emphasize for their online education. Therefore, this study aims to produce a framework ordering the key features and associated sub-factors of web conferencing tools that Sri Lankan tertiary sector students prioritize for their online learning experience.

Specific objectives included assessing the student's perceived importance of the nine key features uncovered in a previous study on expert opinion in the Sri Lankan context [4], prioritizing the key features, and ranking the level of importance of the sub-features to their corresponding key features according to the student's preference.

2. Methodology

This study is an extension of the previous study by De Zoysa et al. [4] on "Expert opinion on selecting a web conferencing tool for synchronous online tertiary education in Sri Lanka". Out of the total of thirteen factors identified in the said study, this study considered only nine key features that were suggested by all three categories of experts namely educational specialists, educational psychologists, and IT specialists. The key features considered in this study included 'Performance', 'Screen Sharing', 'Online event features', 'Collaboration features', 'Security features, 'User-friendliness', 'Customer Support', Pricing, and 'Online evaluation'.

To obtain the student's priorities on the above features the study deployed a quantitative research design. The questionnaires were distributed randomly in the mode of Google Forms to both public and private sector tertiary educational institutes under the purview of the University Grants Commission (UGC) of Sri Lanka.

The UGC statistics of Sri Lanka revealed that in the state universities and associated campuses total number of student enrolment is 123,195 for the year 2020 [6]. This means that the total student count in these government universities and private institutes exceeds the stated count as an undergraduate program runs at least three years. Considering this fact, it is decided that the population for this study is more than 100,000. Thus, the sample size is calculated as 461 according to Krejcie and Morgan [7], at a 95% confidence level and an error rate of 0.05.

Each key feature (Performance, Screen Sharing, Online Event Features, Collaboration Features, Security Features, User-friendliness, Customer Support, Pricing, and Online evaluation) is addressed with a corresponding research hypothesis, assuming it is important to the tertiary students in Sri Lanka. (For example, the hypothesis for performance - Students in Sri Lankan tertiary education consider the performance of web conferencing tools as an important factor for their online learning experience). To assess the validity of these hypotheses, Pearson's Chi-square test was employed. Then the level of importance of the sub-factors for their main characteristic is measured using the exploratory factor analysis and the hierarchy of importance among the key features was established utilizing the second-order factor analysis. Ordering of the key features and sub-factors is done based on the factor loading value generated during the factor analysis.

3. Results

3.1. Hypothesis Test Results

The following Table 1 summarises the results of the Chi-square tests utilized upon the research hypotheses to test the perceived importance of the nine key features.

Table 1. Hypotheses test summary

Hypothesis	Feature	p-value	Decision (at 5% sig. level)	Conclusion
01	Performance	0.0000	Reject null hypothesis	Significantly important
02	Screen Sharing	0.0000	Reject null hypothesis	Significantly important
03	Online event features	0.0000	Reject null hypothesis	Significantly important
04	Collaboration features	0.0004	Reject null hypothesis	Significantly important
05	Security features	0.0000	Reject null hypothesis	Significantly important
06	User Friendliness	0.0000	Reject null hypothesis	Significantly important
07	Customer support	0.0000	Reject null hypothesis	Significantly important
08	Pricing	0.0000	Reject null hypothesis	Significantly important
09	Online Evaluation	0.0002	Reject null hypothesis	Significantly important

According to Table 1, all the p-values are less than 0.05. Therefore, reject all nine of the null hypotheses at a 5% significance level. This indicates a statistically significance difference between the number of students who consider each feature to be important over those who state it is not.

Therefore, it is concluded that the performance, screen-sharing, online event features, collaboration features, security features, user-friendliness, customer support, pricing, and online evaluation of web conferencing tools are all important considerations for Sri Lankan tertiary sector students.

3.2. Ranking the Sub-Factors

Table 2 summarises the level of importance of the sub-factors to their key characteristics according to the factor loadings generated by the exploratory factor analysis.

Table 2. Ranking of the sub-factors to their key features

Key Feature	Variance	Variables to measure the characteristic	Factor Loading	Rank
Performanc e	53.890%	High-quality audio facility	0.790	1
		High-quality Video facility	0.726	2
		Perform well under low bandwidth levels	0.723	3
		Facilitate users to select the bandwidth level	0.665	4
		High-quality Image Facility	0.654	5
Screen Sharing	58.630%	Facilitate desktop sharing	0.832	1
		Facilitate document/file sharing	0.804	2
		Facilitate application sharing	0.786	3
		Facilitate whiteboard sharing	0.782	4
		Facilitates simultaneous sharing of multiple applications by splitting the screen.	0.483	5
		Enable lecturer to control students' sharing facilities	0.391	6
		Enables private sharing among users	0.315	7
Online meeting/ event features	50.264%	Prior automatic reminders to participants	0.805	1
		After a session automatically makes the session recordings available online	0.766	2
		Enables the lecturer to play, pause, and stop study videos as required	0.757	3
		Continue session recording while playing a video	0.755	4
		Continue same session recording after disruptions	0.75	5
		Produce multiple kinds of student attendance reports	0.74	6
		Facilitates the lecturer to mute/unmute students	0.71	7
		Automatically updates the date/time changes of the session to the participants	0.698	8
		Synchronize with the calendars of other applications	0.689	9
		Facilitates real-time muting of bad words	0.662	10
		Enables sounds to the audience immediately when a video commences	0.646	11
		Let students join the session via a phone call	0.644	12
		Initially keep all the participants muted	0.64	13
		Provides the parents a summary of their children's online schedules and attendance. (Parental view)	0.513	14
Collaborati on features	53.248%	Oral communication without any additional devices	0.632	1
		Facilitates the lecturer to enable /disable the audibility of a panel discussion for selected students.	0.827	2
		Assisted whiteboard facility	0.817	3
		Saves the whiteboard contents to be reused during the session	0.793	4
		Ability to form breakout rooms with student visibility	0.781	5
		Allows the lecturer to control students' access to the whiteboard	0.73	6
		Facilitates live casting of the online session.	0.684	7
		Allows the lecturer to authorize public chat messages	0.658	8
		Facilitates the lecturer to enable/disable private chat facility for students	0.607	9
Security Features	54.870%	Let the lecturer decide who should access the class	0.827	1
		Facilitates the lecturer to decide how the participants should access the class.	0.818	2
		Enables the lecturer to remove students from the session if required	0.779	3
		Facilitates lecturer to decide where to store the session recordings	0.777	4
		Enables users to sign in via university account credentials	0.772	5
		Enables the lecturer to decide how the students should access the recordings and other session artifacts	0.747	6
		Enables users to sign in via social networking sites	0.348	7

User-friendliness	60.034%	Provides short and simple steps to get things done from the tool	0.844	1
		The tool should be easy to understand, learn, and use	0.823	2
		Facilitate subtitles in English and any local language	0.815	3
		Supports translation to local languages	0.763	4
		Should provide more than one method to achieve the same functionality	0.728	5
		Facilitate users to join a session via a web browser simply by clicking on a link without having an account	0.662	6
Customer Support	57.784%	Online user guides and video tutorials	0.854	1
		Support on different software versions and hardware devices	0.814	2
		Real-time phone, e-mail, or live chat support	0.765	3
		Frequently asked questions	0.580	4
Pricing	55.659%	Provide all key features at an affordable price.	0.816	1
		Should be able to pay in LKR	0.812	2
		Facilitate different types of structured payment plans	0.761	3
		Offer some free features (40 minutes free etc...)	0.568	4
Online evaluation	64.904%	Facilitates assignment submissions	0.866	1
		Allows shuffled MCQ facility for online evaluations	0.86	2
		Ability to conduct quizzes and exams	0.853	3
		Generates individual student marks for online quizzes	0.841	4
		Makes the students' screens visible to the invigilator during an evaluation	0.754	5
		Captures the students' eye movements and displays alerts on any suspicious movements	0.633	6

As shown in Table 2, the total variance explained exceeds 50%, indicating adequate variability captured by the factors [8]. This implies the extracted components (key features) effectively represent the underlying structure of the data. Furthermore, factor loadings act as correlation coefficients between sub-factors and key features. High absolute values (closer to 1) indicate a stronger association between the sub-factor and its corresponding key feature. Therefore, Table 2 provides valuable insights into the relative importance of sub-factors for each key feature.

The last column of the table shows the significant level of each sub-factor for their corresponding key feature based on the magnitude and direction of factor loadings.

3.3. Ranking the Key Features

Table 3 summarises the hierarchy of importance of the key features according to the factor loadings generated by the second-order factor analysis utilized upon the data collected from Sri Lankan tertiary sector students.

Table 3. Hierarchy of importance of the key features

Key feature	Factor Loading	Rank
Collaboration features	0.924	01
Online meeting features	0.881	02
Pricing	-0.879	03
User-friendliness	0.865	04
Customer support	0.861	05
Security features	0.852	06
Online evaluation	0.830	07
Performance	0.828	08
Screen sharing	0.602	09

Based on the factor loading values the importance of the key features is ranked in Table 3. There is a negative factor loading for *Pricing* which implies a negative relationship between this feature and student preference. However, when ranking the features, only the magnitude is considered.

3.4. Suggested Framework

Combining the outcomes of the above two sections ranking the sub-factors and ranking the key features, a student-centric evaluation framework is formed as follows to assess web conferencing tools in the Sri Lankan context.

Table 4. Student-centric evaluation framework for web conferencing tools (SCEFWCT)

Rank	Characteristics	Sub-Features Rank	Sub-Features
1	Collaboration features	1	Facilitates oral communication without any additional devices
		2	Facilitates the lecturer to enable /disable the audibility of a panel discussion for selected students
		3	Assisted whiteboard facility (Search images, shapes, and formulas online or drag and drop objects, formatting contents)
		4	Saves the whiteboard contents to be reused during the session
		5	Allows the formation of breakout rooms with student visibility (Split the students into groups)
		6	Allows the lecturer to control students' access to the whiteboard
2	Online meeting/Event features	1	Sends automatic reminders to the participants prior to the session
		2	Makes the recordings available online automatically after the session
		3	Enables the lecturer to play, pause, and stop study videos as required
		4	Lets the session recording to continue while playing a video
		5	Continues the same session recording after sudden disruptions
		6	Generates multiple kinds of student attendance reports
		7	Facilitates the lecturer to mute/unmute students as required
		8	Automatically updates the date/time changes of the session to the participants
		9	Ability to synchronize with the calendars of other applications
		10	Facilitates real-time muting of bad words
		11	Enables sounds to the audience immediately when a video commences (no extra step in enabling the sounds)
		12	Facilitates students to join the session via a phone call.
		13	Keeps all the participants muted at the beginning of the class
		14	Provides the parents a summary of their children's online schedules and attendance. (Parental view)
3	Pricing	1	Provide all key features at an affordable price.
		2	Should be able to pay in LKR
		3	Facilitate different types of structured payment plans
		4	Offer some free features (40 minutes free etc...)
4	User-friendliness	1	Provides short and simple steps to get things done from the tool (processes are not too lengthy)
		2	The tool should be easy to understand, learn, and use
		3	Facilitate subtitles in English and any selected local language
		4	Supports translation to local languages (Tooltips, instructions, Menus)
		5	Should provide more than one method to achieve the same functionality
		6	Facilitate users to join a session via a web browser simply by clicking on a link without having an account

5	Customer Support	1	Online user guides and video tutorials
		2	Support on different software versions and hardware devices
		3	Real-time phone, e-mail, or live chat support
		4	Frequently asked questions
6	Security features	1	Facilitates lecturer to decide who should access the class (open access via a sharable link, invitees only)
		2	Facilitates lecturer to decide how the participants should access the class (guest/member, wait in the lobby until authorized, anonymous access)
		3	Enables the lecturer to remove students from the session if required
		4	Facilitates lecturer to decide where to store the session recordings (Local, Server, or Cloud storage)
		5	Enables users to sign in via university account credentials
		6	Enables the lecturer to decide how the students should access the recordings and other session artifacts (Downloadable or only an online view)
		7	Enables users to sign in via social networking sites (Facebook, Instagram)
7	Online Evaluation	1	Facilitates assignment submissions
		2	Allows shuffled MCQ facility for online evaluations
		3	Ability to conduct quizzes and exams
		4	Automatically generates individual student marks for online quizzes
		5	Makes the students' screens visible to the invigilator during an evaluation
		6	Captures the students' eye movements and displays alerts on any suspicious movements
8	Performance	1	High-quality Audio facility
		2	High-quality Video facility
		3	Ability to perform well under low bandwidth levels
		4	Facilitate users to select the required bandwidth level
		5	High-quality Image Facility
9	Screen-Sharing	1	Facilitate desktop sharing
		2	Facilitate document/file sharing
		3	Facilitate application sharing
		4	Facilitate whiteboard sharing
		5	Facilitates simultaneous sharing of multiple applications by splitting the screen.
		6	Facilitates the lecturer to enable/disable sharing facilities for students
		7	Enables private sharing among users

The framework above reveals that the Sri Lankan tertiary sector students prioritize the collaboration features of a web conferencing tool the most followed by online meeting/event features, pricing, user-friendliness, customer support, security features, online evaluation, performance, and screen sharing, respectively.

4. Discussion

The findings of this study are in line with the findings by De Zoysa *et al*. [4] on the expert opinion on selecting a web conferencing tool for online tertiary education in Sri Lanka. This study confirms that not only the experts in the Sri Lankan tertiary education sector but also the student too values performance', 'compatibility', 'screen sharing', 'online event features', 'collaboration features', 'security features, 'user-friendliness', 'customer support', pricing', and 'online evaluation' when selecting a web conferencing tool. However, there were three more factors discovered by De Zoysa *et al.* [4] that were not considered in this study. These are namely 'value-added services', 'admin functionality', and 'setting standards and user training'.

In addition to checking whether these factors are important for Sri Lankan students, this study moved one step further by prioritizing their order of importance to the Sri Lankan tertiary sector students.

Furthermore, this study and Mayrhofer *et al.* [9] emphasize the similar core functionalities as important to be considered when selecting a web conferencing tool such as 'event management', 'communication', and 'user guidance'. However, there are some key differences in the terminology used in the two articles. 'event management', 'communication', and 'user guidance' in Mayrhofer's article refer to online meeting/event features, collaboration, and user-friendliness respectively in this study [9]. Mayrhofer's article collaboration encompasses screen sharing facility in this study [9]. Notably, security features and customer support are included as important selection criteria in both articles. Security features has mentioned as a factor to be considered when selecting web conferencing tools by Nedeva *et al*., [10], Daniel *et al*., [11], and Chia *et al.,* [12] in their articles. Mayrhofer et al. [9] have further stated 'Demo and trial' as a key feature. However, it was not included in this study.

Overall, these comparisons suggest that this study is in line with many previous studies. However, it identifies not only the core characteristics but also searches into associated sub-factors and prioritizes their level of importance as perceived by the students of the tertiary education sector of Sri Lanka. By presenting these findings as a framework this research offers a more comprehensive and actionable aid for the selection of web conferencing tools.

5. Conclusion

This study presents a framework for evaluating web conferencing tools specifically for online tertiary education in Sri Lanka from the student's perspective. The framework is drawn upon nine key features namely 'performance', 'screen sharing', 'online event features', 'collaboration features', 'security features, 'user-friendliness', 'customer support', pricing, and 'online evaluation'.

The result of the hypothesis testing reflected that the students of the Sri Lankan tertiary education sector place high value on all these key features when choosing a web conferencing tool for their online learning experience.

Furthermore, the framework derived indicated that the collaboration features of the web conferencing tools are valued the most by the students for their online learning experience. Subsequently, online meeting/event features, pricing, user-friendliness, customer support, security features, online evaluation, performance, and screen sharing respectively are in the hierarchy of the Sri Lankan tertiary sector student preference.

Moreover, there was a unique finding emerged in the pricing factor. Its negative factor loading indicates an inverse relationship between pricing and student preference. This suggests that affordability is a considerable factor for Sri Lankan tertiary students, hence tools with high prices might have lower adoption despite good features.

The findings of this study would greatly assist educational institutes in prioritizing features and pricing strategies to better cater to student needs. At the same time, it will empower the students to make informed choices when selecting a web conferencing tool for their online learning experience. Furthermore, the research can be extended to encompass the needs of lecturers and administrators to create a holistic framework applicable to all stakeholders within the Sri Lankan online tertiary sector. Additionally, investigating deeper into specific feature preferences within each key factor can offer detailed insights for future development and further improvement of web conferencing tools. Finally, this study recommends that Sri Lankan tertiary educational institutes consider these key student-centric factors to optimize the online learning experience. This would likely lead to increased engagement, improved learning outcomes, and ultimately greater student satisfaction.

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