Advances in Economics, Business and Management Research, volume 182
Proceedings of the 2021 International Conference on Economic Development and Business Culture (ICEDBC 2021)

On and Beyond -- Video Conferencing in Singapore

Cheng Zihao[1]

[1]*Junior College section, Hwa Chong Institution, Singapore 269734, Singapore, 161908h@student.hci.edu.sg*

ABSTRACT
This paper assesses video conferencing applications for education purposes in Singapore. This paper begins with an analysis of related works to provide basic situation report for local video conferencing applications for education. The author then conducts online surveys and virtual Focused Group Discussions on key features that make certain applications achieve large market share. Key traits of various successful applications, such as Zoom and Google Meet, are early government promotion, significant innovative potential, and large initial investments. This work authenticates these claims made by online respondents using the concept of Price Elasticity of Demand (PED) and hence suggest similar strategies to Singaporean companies to improve their applications. However, the author advices caution for companies that intend to enter this market due to high initial investments, lack of revenue, and limited growth potential unless the pandemic persists. Additionally, PED is not the only tool that can be used to analyze the given situation and could be complemented with other models and theories in future works. At the end of this work, the author identifies limitations of the research, including the lack of recent related works that factor in the strong impact on video conferencing applications by the COVID-19 pandemic, relatively small sample size, and limited involvement in the Focused Group Discussions.

Keywords: *Video conferencing, mobile applications, Price Elasticity of Demand.*

1. INTRODUCTION

This research is closely related to the ongoing COVID-19 pandemic, during which Singapore is susceptible to cluster and community spread [1]. On 7 April 2020, the Singaporean government implemented stringent 'circuit breaker' measures [2], including mandatory work-from-home policies, prohibition of social gatherings, and closures of sports and recreational facilities.

1.1. Research rationale

Singaporean students conducted Home Based Learning (HBL) during 'circuit breaker', and continue to learn from home once every two weeks in 2021 [3]. Hence an application that allows effective real-time teacher-student interaction is badly needed. Video conferencing applications, such as Zoom and Google Meet, have assisted and will continue to assist effective student-teacher interaction during HBL. They can also be used for consultations. When combined with pre-recorded lessons and follow-up quizzes, video conferencing applications will revolutionize teaching and learning by creating unique experience for each student.

However, the potential of video-conferencing applications extends beyond teaching. These applications can also connect families and business partners from different time zones and countries.

"On" in the research report title refers to "On Screen", which is a direct referencing to video conferencing applications. "Beyond" refers to "Beyond Screen", which represents the tremendous potential of video conferencing applications the research is about to discover.

1.2. Research questions

This research aims to answer the following questions:

1.What are the major video conferencing applications in Singapore?

2.What contribute to these applications' large market shares?

3.How can start-ups learn from successful players?

4.How can existing companies improve their current applications?

1.3. Related Work

Reliable resources were obtained online to understand the video conferencing market in Singapore.

"Even though business activities have now resumed, the 47-year-old still holds many of her business meetings online [4]." This fact indicates the rising adoption of video conferencing applications. Real-time video recordings by computer cameras and phone cameras offer a close imitation of real faces. Video conferencing applications also allow real-time audio exchanges and text messages. These functions provide a close substitute to face-to-face interaction. Video chats are more convenient because these can happen almost anytime and anywhere. This is more so in informal occasions where physical presence is not a necessity.

"The company hit $663.5 million in revenue, up 355% year-on-year [5]." 458% and 355% are huge numbers; these figures provide accurate and undeniable proof that Zoom was extremely successful in 2020. "Learn from home" and "Work from home" policies played a major role in boosting revenue, market share, and recognition of Zoom. These policies forced teachers, students, and workers to stay home to complete their tasks, usually via video conferencing applications. Consequently, more people used Zoom and paid for business subscription plans.

"Initially used in higher education, videoconferencing has now been established in many schools [6]." Despite the large amount of existent literature that describes the experience of videoconferencing using traditional pedagogies, much less has been published on the contextual factors that lead to effective learning outcomes and innovative uses of video conferencing. Video conferencing has immense potential to integrate emerging technologies such as holograms and haptic devices and create immersive augmented-reality learning environment.

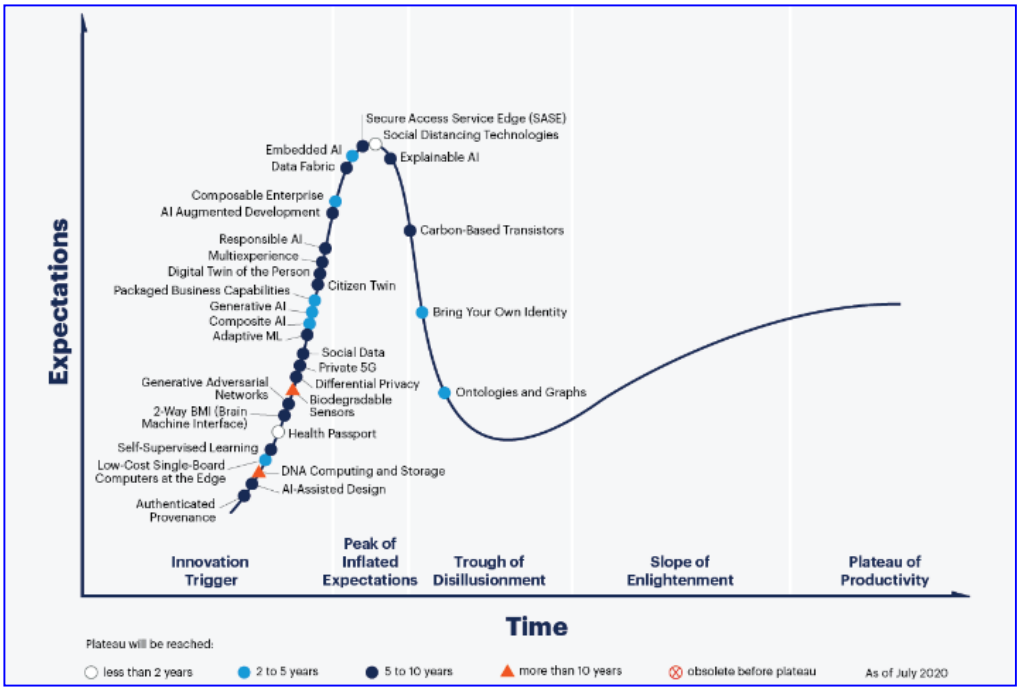

Figure 1 Hype Cycle for Emerging Technologies, 2020

Video conferencing is not seen on figure on, which means it has entered the "plateau of productivity" in the Hype Cycle of Emerging Technologies. “This Hype Cycle highlights technologies that will significantly affect business, society and people over the next five to 10 years [7]” says Brian Burke, Research VP, Gartner. Video conferencing applications are not on the graph. It is most likely because video conferencing has matured during the past decade and hence cannot be classified as an emerging technology. For instance, P2P technology, the very base of video conferencing applications, is mature and has seen many uses in the industry such as online trading. There are many who have a good grasp of P2P, and a company will not encounter much difficulty in developing a new video conferencing application, provided that they have relevant expertise and sufficient time and monetary support.

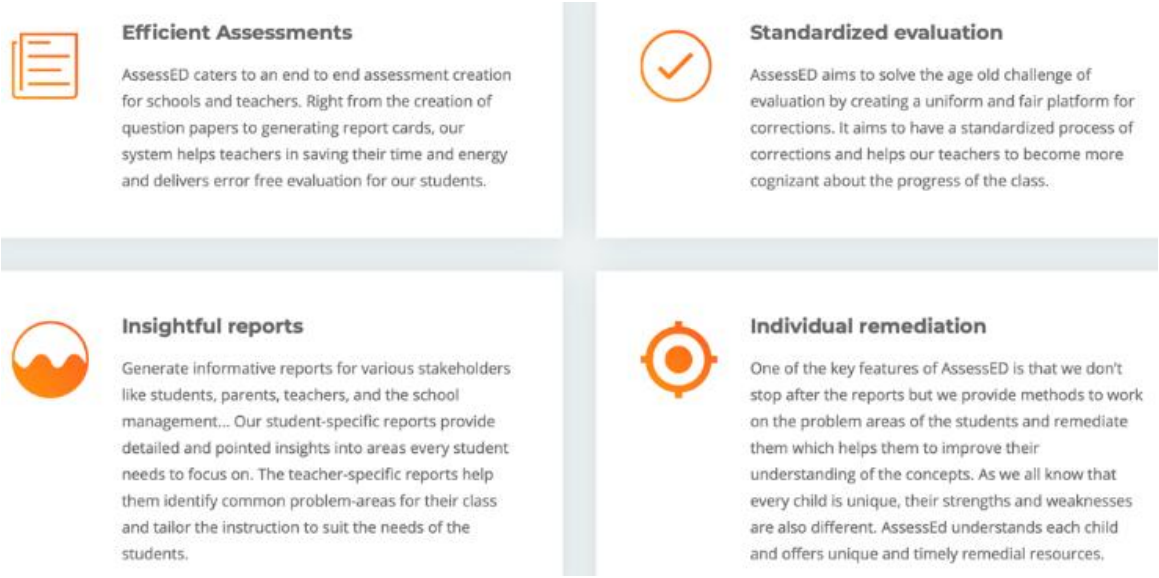

Figure 2 Digital Aristotle

As seen from figure 2, Digital Aristotle is an online learning platform. This product applies artificial intelligence, natural language processing and machine learning to deliver meaningful insights from data, and can be customised to meet individual needs [8]. Digital Aristotle is a good example of online learning. It illustrates the possibility of a video conferencing application specially designed for education. Compared to traditional ways of teaching, such online learning platform can drastically free up teachers by providing students with pre-recorded lessons. Teachers can spend more time on analysing different students' performance and tailoring specific solutions for students to improve their academic results. Additionally, students can learn at their own paces by selecting courses at different difficulty levels. This is how video conferencing applications have the potential to revolutionise education.

"Video conferences are severely hindered by the lack of eye contact [9]" It illustrate that current video-conferencing applications are not perfect and cannot yet fully replace face-to-face interaction. The document presents a gaze correction mechanism based on a single Kinect sensor so as to preserves both authentic facial expressions and movements. The video conferencing application market is highly competitive: in order to survive and thrive, new applications should differentiate themselves as much as possible from the existing applications to attract customers and build up their loyalty.

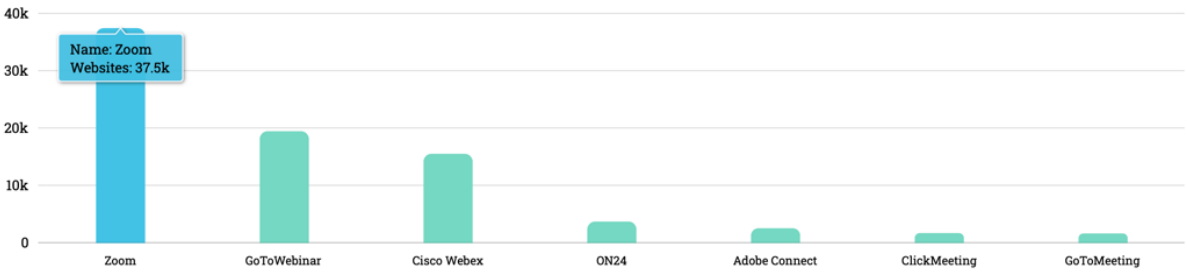

Figure 3 Bar chart for Zoom and their top competitors

The bar chart [10] in figure 3 shows the market share of teleconferencing applications in the United States. Zoom, GoToWebinar and Cisco WebEx are at the top of this list. No market share data in Singapore is available, hence objective and accurate data is unavailable to analyze the Singaporean market of video conferencing applications. This calls for first-hand data collections which will be illustrated further in the "survey results" and "FGD results" chapter of the report.

"The use of videoconferencing for a broad range of learning purposes is now established in many schools [11]" shows that technological advancements enable increased adoption of video conferencing applications in schools. Technological breakthroughs drastically boost the ability and reduce the cost of such applications. For example, the basic version of Zoom is free of charge and offers all the facilities most people will need [12]. It is reasonable to assume that video conferencing applications will incorporate more functions, such as gaze correction mechanism. If companies can harness these new technological breakthroughs, they can "stay ahead of the curve" and offer a superior application to their users.

"In addition to regular video conferencing, preservice teachers now have opportunities to view their own teaching video clips and receive feedback from their peers and university supervisors [13]. " Firstly, this article suggests the potential of video conferencing applications in training teachers, on top of training students. This is due to the fact that new technologies enable these applications to record the screen and then save as videos for teachers to review their own performance, which is of significant importance as this provides a brand-new way to evaluating the teachers' performance--self-review. Students' feedback is second-handed and hence may not be an accurate reflection of the teachers' efforts. Moreover, the teachers' self-reflections contribute to their accurate long-term memory of learning points.

2. RESEARCH METHODOLOGY

The literature review has provided answers to various research questions aforementioned:

1. COVID-19 has significantly contributed to the growth of market share, profit, and recognition of video conferencing applications.

2. Key technologies that support the basic functions of video conferencing applications are mature but emerging technologies will continue to improve the user experience and reduce cost of maintenance.

3. Video chat functions and screen recording functions of the applications can be integrated into a large platform and exchange information with other technologies, such as augmented reality or virtual reality, in order to enhance the teaching-learning experience.

However, the market share of video conferencing applications in Singapore and its driving factors are not available on the Internet. This prompts me to collect first-hand data collection in two ways.

I posted an online questionnaire on the virtual chat platform QQ, in order to minimize time spent on completing the survey and maximize the chance of respondents taking the survey. The questionnaire contains two most crucial questions:

"What video conferencing application do you use most frequently?"

"What is the most important feature to such an application?"

Secondly, I invited selected survey respondents to attend a Focused Group Discussion, which aims to achieve the following objectives:

1.Identify certain features that major video conferencing applications have.

2.Compare and contrast their features and market performance.

3.Identify features that contribute to market success and their applicability to new as well as existing applications.

2.1. Survey Results

I received 41 effective responses from students aged 16 to 21 in Singapore. The first diagram recorded the response to the question "What video conferencing application do you use most frequently?" It is observed from table 1 that Zoom and Google Meet are used more frequently, probably because school teachers use these two applications for online lectures and tutorials. For example, for class 20S7D and 20S7B, the GCE-A Level H2 Economic lectures are conducted once every two weeks via Google Meet. Virtual Co-Curricular Activities-Chinese Debate sessions are conducted every Wednesday via Zoom.

Table 1 "What video conferencing application do you use most frequently?"

App Type	Count	Net
Zoom	19	41
Google Meet	15	
Microsoft Teams	3	
Discord	2	
Skype	2	

Table 2 recorded the most important features that the respondents think of a video conferencing application. Those include high quality video & audio, chat function & screen sharing, free of charge as well as virtual background. The most important feature as observed is "High quality video & audio", which is also the most basic function of video conferencing application. This implies that no matter how well the other advanced functions such as screen recording or breakout rooms are implemented, video and audio quality is still the most important concern of consumers.

Table 2 Crucial features of a video conferencing application

Identified Features	Count	Net
High quality video & audio	15	41
Chat function and screen sharing	14	
Free of charge	7	
Virtual Background	5	

2.2. Focus Group Discussion Results

I selected 9 out of the 41 survey respondents to interview over Zoom. The discussion focused on the driving factors and restraining factors of a Singaporean start-up attempting to enter the video conferencing market. The following list summarizes the result:

Driving factors:

1.Rising adoption of governments, enterprises, and schools, especially during COVID-19.

2.The rising need for realistic interactions with families and friends overseas.

3.Need for overseas business meeting amid international travel restrictions.

Restraining factors:

1.High initial cost of development of the application,

2.No advertisements are observed on any current video conferencing applications.

3.The prevalence of free video conferencing applications also increase difficulty to profit.

3. DISCUSSIONS

The above "restraining factors" of the focused group discussion mentions difficulty to profit due to large numbers of free applications. In order to explain the consumers' decision based on the price of applications, the concept of price elasticity of demand (PED) must be considered.

PED measures the degree of responsiveness of quantity demanded of a good to its own price changes, ceteris paribus [14]. Video conferencing applications are necessities to Singaporean students during the pandemic because of the full HBL in April 2020 and the blended learning framework in 2021, which makes video conferencing applications price inelastic. However, one certain application is price-elastic since there are many close substitutes available to Singaporean teachers and students. They can easily download other video conferencing applications if the existing application.

As the new video conferencing application is price elastic, a price increase will result in a disproportionate decrease in sales and a revenue decrease. Given that the fixed cost and operating cost are almost constant, the profitability of the application will decrease. However, the price of application cannot be below zero. Because basic versions of video conferencing applications are free, decreasing the price further is impossible. This presents a dilemma; the new application is not as popular as the existing major applications while they have the same price. So, start-ups might be discouraged to charge their customers for using the basic version of the application.

There is one strategy, however, that enables new applications to stand out among the rest and make profits--differentiation. New applications have an advantage in employing and integrating new technologies due to their more recent construct, such as the gaze correction function aforementioned. Such innovations can make new applications superior to the existing ones. Since they better suit consumers' needs, they become necessities, and therefore price-inelastic. This means that consumers continue to use the application despite its higher price, because it provides very different services than its potential substitutes. Although using the special video conferencing application incur higher costs, consumers have no other choice but to use it, if they want to enjoy specific services that only this application can provide.

4. AREA OF IMPROVEMENTS

Although much time and effort have been put into this research, there are still unaddressed gaps:

Firstly, some articles cited in this report were published during the 2010s and did not consider the impact on video conferencing of COVID-19. After multiple countries have issued the "stay home notice" or similar policies in 2020 and 2021, video conferencing applications saw increasing adoption at many sectors, including government, education, and the labor force. COVID-19 has shifted the future outlook of video conferencing applications. As a result, such articles should be replaced by more recent ones if they are available.

Secondly, the survey covers few respondents, its result is not an accurate sample of the student population. Although each individual being selected has no effect on the chances of any other individual selected, every individual of the population does not have an equal chance of being selected. So, the survey does not select a random sample of the student population.

Thirdly, the focus group discussion can be expanded to involve more professions. Teachers and government officials can also influence the acceptance and effectiveness of video conferencing applications. Which video conferencing application to use for online lectures and tutorials is up to the teacher's choice, and this decision will affect students' usage of video conferencing applications because the students have to use the same application to attend the lectures and tutorials. Government officials' decision to close schools with confirmed cases of COVID-19 will force teachers and students to use video conferencing applications more often since they have to teach and learn from home.

5. CONCLUSIONS

During COVID-19, video conferencing applications have experienced significant rise in profit and public recognition. However, the rate of growth is unsustainable from 2021 onwards, new companies should not hastily move in to develop new application solely based on unprecedented success of video conferencing applications if the pandemic goes on.

However, the need for real-time interactions with families and friends overseas as well as international business meeting amid international travel restrictions continue to rise. The most recent example being Twitter announced "plans for work from home indefinitely" [15].

New companies should also consider the high initial cost of application development, in terms of the opportunity costs of manpower, time, as well as capital. They should also notice the prevalence of free applications, which makes profit significantly harder due to the price elastic nature of the product.

All players should focus on improving reliability and performance of key technologies, such as P2P. Emerging technologies serve as the "wow" factor that differentiate new applications from existing ones, which brings about increased user loyalty and profitability.

Companies should also seek and secure external collaborations with other education platforms, so that functions of the applications can be integrated to a large platform and exchange information with other emerging technologies, improving the popularity and profitability of video conferencing applications.

REFERENCES

[1] COVID-19 map. (n.d.). Retrieved February 27, 2021, from https://coronavirus.jhu.edu/map.html

[2] Situation report. (n.d.). Retrieved February 27, 2021, from https://www.moh.gov.sg/covid-19/situation-report

[3] Blended learning to enhance schooling experience and further develop students into self-directed learners. (n.d.). Retrieved February 28, 2021, from https://www.moe.gov.sg/news/press-releases/20201229-blended-learning-to-enhance-schooling-experience-and-further-develop-students-into-self-directed-learners

[4] Tan, T. (2020, August 18). Video conferencing looks set to stay. Retrieved February 27, 2021, from https://www.straitstimes.com/tech/video-conferencing-looks-set-to-stay.

[5] Yu, E. (2020, October 09). Zoom looks For post-pandemic, APAC growth. Retrieved February 27, 2021, from https://www.zdnet.com/article/zoom-looks-for-post-pandemic-apac-growth/

[6] Themelis, C., & Sime, J. (2020). From video-conferencing To HOLOPORTATION and Haptics: How emerging technologies can Enhance presence in online education? *Emerging Technologies and Pedagogies in the Curriculum*,261-276. doi:10.1007/978-981-15-0618-5_16

[7] Gartner identifies FIVE emerging trends that will drive technology innovation for the next decade. (n.d.). Retrieved February 27, 2021, from https://www.gartner.com/en/newsroom/press-releases/2020-08-18-gartner-identifies-five-emerging-trends-that-will-drive-technology-innovation-for-the-next-decade

[8] Digital Aristotle - Empowering Data, Fuelling Insight. (n.d.). Retrieved February 27, 2021, from http://www.digitalaristotle.ai/

[9] Zurich, C., Kuster, C., Zurich, E., Profile, E., Zurich, T., Popa, T., . . . Authors: Claudia Kuster ETH Zurich ETH ZurichView Profile. (2012, November 01). Gaze correction for home video conferencing. Retrieved February 27, 2021, from https://dl.acm.org/doi/abs/10.1145/2366145.2366193

[10] Datanyze. (n.d.). Zoom rooms market share and competitor Report: Compare to ZOOM ROOMS, ZOOM, GOTOWEBINAR. Retrieved February 27, 2021, from https://www.datanyze.com/market-share/web-conferencing--52/zoom-rooms-market-share

[11] Images of the future for education? Videoconferencing: A literature review. (n.d.). Retrieved February 27, 2021, from https://www.tandfonline.com/doi/abs/10.1080/14759939X.2010.513761

[12] Khalili, J. (2021, February 04). What is zoom? How it works, tips and tricks and best alternatives. Retrieved February 27, 2021, from https://www.techradar.com/sg/news/what-is-zoom-how-does-it-work-tips-and-tricks-plus-best-alternatives

[13] Sharpe, L., Hu, C., Crawford, L., Gopinathan, S., Khine, M., Moo, S., & Wong, A. (2003, June 28). Enhancing multipoint desktop video conferencing (mdvc) with lesson video clips: Recent developments in PRE-SERVICE teaching practice in Singapore. Retrieved February 27, 2021, from https://www.sciencedirect.com/science/article/abs/pii/S0742051X03000507

[14] Boundless. (n.d.). Boundless economics. Retrieved February 28, 2021, from https://courses.lumenlearning.com/boundless-economics/chapter/price-elasticity-of-demand/

[15] Dwoskin, E. (2020, October 01). Americans might never go back to the office, and Twitter is leading the charge. Retrieved February 28, 2021, from https://www.washingtonpost.com/technology/2020/10/01/twitter-work-from-home/?arc404=true