Next-Gen Distance Learning: Propose Hologram Features Based on Students' Perceptions of Online Teaching Tools in Visual Arts Education

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***Abstract*—The global education system has undergone significant changes due to the COVID-19 pandemic, leading to a widespread transition to online learning. This shift has particularly affected art and design courses, which typically depend on practical, visual teaching methods and live demonstrations. To tackle these issues, this research gathered responses from undergraduate students at the university to understand how online teaching tools can enhance their distance learning experience, by gaining insights into their views on online education and the application of teaching tools such as holographic technology. Data were gathered using Likert-scale questionnaires and open-ended questions to assess students' experiences, needs, and expectations of online teaching tools for lectures, learning activities, and assessments during the first semester of 2021. The results indicate that students favor interactive and engaging platforms like Microsoft Teams and show a strong interest in gamified learning activities. Moreover, students emphasized the importance of secure and formal online assessments. This research underscores the potential of using holograms to offer immersive and engaging educational experiences, which could revolutionize remote art and design education.**

***Keywords*—holograms, art and design, COVID-19, online learning, online teaching tools**

I. Introduction

In the spring of 2020, universities around the globe were compelled to close their campuses due to the COVID-19 pandemic, which was declared a global crisis by the World Health Organization [1]. This sudden shift to online education was necessary to enforce social distancing and protect public health [2]. As a result, both educators and students had to quickly adapt to a fully online mode of instruction, facing significant challenges in maintaining effective educational practices [3]. This required universities to rethink their teaching methodologies and academic activities to fit an online environment, with modifications to address the specific needs of different courses.

Developing effective online teaching and learning strategies requires focusing on three main areas: instructional methods, learning activities, and assessment tools, to meet educational goals. Jeronen *et al.* [4] note that instructional strategies include various teaching techniques that help students learn and understand course material. In this setting, lecturers in the art and design program at Universiti Malaysia Sarawak (UNIMAS) have utilized several technological platforms like Google Classroom, Zoom, WebEx, and Microsoft Teams to conduct classes. Presentation tools such as Microsoft PowerPoint, Prezi, YouTube videos, and Miro are frequently used to share information [5]. Additionally, online assessment tools like Poll Quizzes, Google Forms, Quizlet, and Kahoot are commonly employed to continuously monitor student progress and learning experiences.

Beyond these tools, higher education institutions in Malaysia have implemented various technological platforms to support online learning. For instance, UNIMAS developed the eLEAP platform to supplement face-to-face teaching for all academic programs during the COVID-19 pandemic, including art and design courses. These courses often require highly visual and practical training methods, such as live demonstrations, to effectively teach new skills. Challenges in using software for graphic or animation design highlight the need for demonstration-based learning, where lecturers provide theoretical knowledge and practical examples of technology-based learning media.

Apart from that, distance learning introduces several obstacles for art and design education. One major challenge is the difficulty in assessing and providing feedback on student work accurately, as nuances in color, texture, and detail might not be effectively conveyed on screen. Additionally, the lack of hands-on experience and access to physical materials can impede the development of practical skills. Furthermore, social interaction, essential for collaborative projects and creative brainstorming, is limited in a virtual environment. Technical issues, such as poor internet connectivity and inadequate software tools, can also disrupt the learning process. However, integrating holographic technology could address many of these challenges. Holograms can provide detailed, three-dimensional visualizations of student work, preserving the nuances needed for accurate assessment and feedback. They can also simulate hands-on experiences by allowing students to manipulate virtual objects as if they were real, aiding skill development. Additionally, holograms can create immersive, interactive environments that facilitate social interaction and collaborative projects, despite physical distance. These innovations can help ensure art and design students receive a comprehensive and effective education during distance learning.

A hologram is a 3D image created using laser light that shows an object in depth, allowing it to appear as though it's physically present and can be viewed from various angles. Technically, at present, holograms can only be displayed using the two types of devices illustrated in Figs. 1 and 2. Fig. 1 shows the fan hologram device used for displaying 3D

models and animations, and Fig. 2 shows the pyramid projector hologram device, which operates on the principle of Pepper's ghost, creating a 3D-like illusion by making the video appear to hover in mid-air [6]. In online learning, holograms create interactive, three-dimensional images that students can engage with in real-time. At this stage, the hologram is still in the conceptual phase; therefore, Fig. 3 illustrates the proposed concept of online teaching holography tools for visual arts education.

Fig. 1. Fan hologram device used for showing 3D models and animation [6].

Fig. 2. Pyramid projector hologram device used for showing 3D animation [6].

Fig. 3. Propose concept of holograms in online learning. (https://www.freepik.com/premium-ai-image/child-boy-working-with-laptop-earth-sphere-hud-circles-hologram-with-metaverse-big-data-cubes-distance-learning-online-education_333419801.htm#from_view=detail_alsolike)

Holographic technology presents a promising solution to these challenges by offering immersive and interactive learning experiences that can significantly enhance the teaching and learning process in art and design education. Holograms can deliver three-dimensional visualizations and live demonstrations, making complex concepts more accessible and engaging for students. Integrating holograms into online teaching tools can help bridge the gap between traditional hands-on instruction and the limitations of remote learning, ensuring that students receive a comprehensive and effective education.

Effective use of online teaching tools in art and design education must ensure clear visual communication and easy access to live demonstrations. It is also essential to promote excellent communication skills, thoughtful instructional design, and active learner involvement in instructional methods, learning activities, and assessments [7]. This research surveyed undergraduate students at the university to understand their perspectives on online education and the use of teaching tools, enhance their distance learning experience.

II. Literature Review

Wekerle *et al.* [8] highlighted the significance of using interactive learning activities to offer students informal feedback on their grasp of the material after lectures. In the context of online learning, instructors in art and design programs often utilize platforms such as Kahoot, Flipgrid, Padlet, Miro, and WhatsApp. These tools are designed to enhance discussions, problem-solving, and design tasks, catering to the unique needs of each course.

Contemporary research underscores the importance of adopting a learner-centered approach in online education rather than focusing solely on content delivery. Hattie and Yates [9] argue that successful online learning involves customizing teaching strategies to fit the needs of individual students, which improves engagement and educational outcomes. Similarly, Johnson *et al.* [10] emphasizes the need for interactive and participatory online environments to foster deeper student involvement.

Formative assessment is crucial for enhancing student performance through feedback. Nguyen and McCauley [11] describe formative assessment as a continuous process of evaluating student progress to refine teaching strategies and boost learning effectiveness. The foundational work by Black and Wiliam [12] on formative assessment remains pertinent, illustrating that regular feedback is vital for effective learning.

Recent studies on online learning have highlighted significant developments in the integration of technology into educational environments. Li *et al.* [13] found that students' preferences significantly mediate their satisfaction with online learning during the COVID-19 pandemic. Similarly, Nguyen *et al.* [14] provided insights into students' perceptions of remote learning methods, emphasizing that a combination of interactive and engaging tools is essential for effective online education. Additionally, Vermeulen and Volman [15] examined the online learning experiences of Dutch university students, suggesting that promoting student engagement through tailored strategies is crucial for maintaining motivation and participation. Incorporating elements of fun into these strategies was found to significantly

boost student engagement and satisfaction. These studies collectively underscore the importance of understanding student experiences and leveraging technology to enhance online education.

Furthermore, research by Bedi [16] and Turk *et al.* [17] delves into specific strategies for improving student engagement and satisfaction in online learning. Bedi's study highlights the role of continuous learning and engagement strategies in fostering a productive online learning environment. Meanwhile, Turk *et al*. [17] conducted a mixed methods study to explore students' expectations and experiences with engagement strategies, revealing that personalized and enjoyable approaches significantly impact student satisfaction and engagement. These findings align with broader theoretical frameworks, such as constructivist theory and Maslow's Hierarchy of Needs, which emphasize the importance of addressing students' needs and creating engaging, supportive, and fun learning environments. Integrating technologies like holographic tools can further support these objectives by providing immersive, interactive, and enjoyable experiences that enhance learning outcomes.

Recent technological advancements, such as Augmented Reality (AR) and Virtual Reality (VR), have demonstrated considerable potential for enriching online education. Choi and Kim [18] found that AR and VR offer immersive and interactive experiences, which are especially advantageous for fields that require visual and practical skills. Building on this, holographic technology emerges as a promising tool with similar benefits. Holograms provide three-dimensional visualizations and interactive features, making complex concepts more engaging and easier to understand.

Incorporating holograms into online teaching tools could significantly enhance the educational experience for art and design students. Holograms offer opportunities for interactive learning by enabling students to interact with virtual models and receive instant feedback. This aligns with Anderson and Dron's [19] findings, which highlight the importance of interactive and immersive learning environments. Additionally, holograms can be utilized in formative assessments to create dynamic evaluation methods, addressing the need for effective feedback and monitoring [11].

The integration of holographic technology into online education holds the potential to revolutionize distance learning, delivering an engaging and immersive educational experience that caters to the evolving needs of students and educators. Research on holographic technology reveals significant potential in visual arts education. For instance, holograms can showcase intricate details and perspectives of artworks that traditional methods can't replicate [20]. Building on existing theories, hologram features could enhance visual arts education by providing interactive, three-dimensional models that bring artistic concepts to life. Holograms enrich the learning experience by enabling students to manipulate and view artworks from various angles, thus offering a comprehensive understanding of artistic techniques and processes [21]. Additionally, holographic technology can create collaborative learning environments where students share and critique each other's work more interactively [22]. This technology has the potential to transform traditional art lessons into dynamic and engaging experiences, bridging the gap between physical and digital art forms, and fostering a deeper connection to the subject matter.

III. Methodology

This quantitative study explores online teaching tools based on students' learning experiences in art and design courses. This study aims to determine how advanced online tools can improve distance learning. It collects feedback from undergraduate students to gain insight into the effectiveness of these tools, focusing on instructional methods, learning activities, and assessment strategies [23]. Additionally, the study suggests that incorporating holographic features could enhance visual arts education by providing interactive, three-dimensional models that bring artistic concepts to life. These tools could enrich learning by allowing students to interact with artworks dynamically, fostering a deeper connection to the subject matter and improving their overall educational experience. A descriptive research design is used to assess variables related to students' interactions with current online educational tools. Data is collected using an online survey, adapted from previous studies, and administered through Google Forms, facilitating efficient data collection and analysis within a digital framework. The online survey designed to collect student feedback on improving distance learning through advanced online tools was based on well-established research instruments [24]. This survey comprised questions targeting key areas such as instructional effectiveness, learning activities, and assessment strategies. To ensure its validity, the questions were derived from previously validated instruments, ensuring they accurately captured the necessary constructs. Conducted through Google Forms, the survey allowed for efficient data collection and analysis. The digital format ensured systematic processing, minimizing human error and maintaining data integrity. The findings gained are important by incorporating holographic features into online education enhances the learning experience for art and design students by providing immersive, interactive activities that cater to diverse learning preferences.

Participants include first, second, and third-year undergraduate students from the Faculty of Applied and Creative Arts at Universiti Malaysia Sarawak (UNIMAS). The study includes 66 respondents, with a gender distribution of 66.2% female and 37.9% male. The age distribution of participants is as follows: under 21 years old (19.7%), 21 years old (33.3%), 22 years old (31.8%), 23 years old (9.1%), 24 years old (4.5%), and over 24 years old (1.5%). The participants' academic year is divided into first year (28.8%), second-year (30.3%), and third-year (40.9%). Regarding their educational background, 71.9% have completed STPM, 7.8% have completed Matriculation, and 20.3% hold a Diploma. Most students live in urban areas (51.1%) and reside in their own homes (90.9%). Details of the demographics are outlined in Table 1.

Responses are quantitatively assessed using percentage analysis to evaluate students' views on online education and the tools utilized by instructors. The data is organized according to a five-point Likert scale, with additional

open-ended questions to gather comprehensive feedback. The analysis concentrates on three primary sentiment categories: "Disliked," "Neutral," and "Liked," to enable clear and structured reporting and discussion of the results.

Table 1. Demographic background

Participants Identify		Total Number	Percentage
Gender	Male	25	37.9%
	Female	41	62.1%
Age	Below 21	13	19.7%
	21	22	33.3%
	22	21	31.8%
	24	3	4.5%
	Above 24	1	1.5%
Year of Study	First	19	28.8%
	Second	20	30.3%
	Third	27	40.9%
Qualification	STPM	46	71.9%
	Matriculation	5	7.8%
	Diploma	13	20.3%
Residential Area	Urban	34	51.5%
	Rural	32	48.5%
Location of Residence	Home	60	90.9%
	Hostel	3	4.5%
	Rental	3	4.5%

IV. Findings and Results

A. Overall Perceptions Online Learning

The students' perception in this study is assessed based on two categories, which are learning the Art and Design courses at online platform, and their perception of the live sessions compared to offline videos. In Table 2, data on the overall perceptions of the components mentioned were analyzed according to the participants' percentages.

Table 2. Students' overall perception of online learning

Level of Perception	Percentage
I hate it	1.7%
I don't like it	16.9%
Neutral	50.8%
I like it	20.3%
I love it	10.2%

As the finding showed in Table 2, it indicated that 18.6% of the students did not like online learning, while 30.5% was satisfied with it. In addition, 50.8% of the students have stayed neutral, which does not have any positive or negative comments about the online learning. Therefore, it can be concluded that the overall satisfaction level is higher than dissatisfaction of the student towards online learning.

Table 3. Students' perceptions of live sessions with the lecturer instead of offline videos

Level of Perception	Percentage
I hate it	0%
I don't like it	0%
Neutral	45.5%
I like it	31.8%
I love it	22.7%

Besides that, Table 3 gives the information about the perception of students from the live sessions. Hence, it can be observed that 54.5 percent of the students were satisfied, 45.5 percent were neutral, and none of them were dissatisfied with live sessions. Therefore, the finding reveals the students' perception are in line with the results from Table 2, which indicated that students are more preferred synchronous online classes compared to the asynchronous with pre-recorded video. They like to have more interaction with the lecturers to discuss the topic.

B. Perception on Online Teaching Tools

All the courses of Faculty of Applied and Creative Art (FACA), UNMAS was taught online using various technological platforms and tools, which depends on the nature of the courses and lecturers, to conduct the online classes throughout semester 1 (2021/2022) for 14 weeks. The students' perception towards the use of online teaching tools in Art and Design courses are analyzed based on the three teaching aspects of instructional, learning activities and assessment. As outlined by Rapanta *et al.* [7], the effectively used of online teaching tools in these aspects are important to ensure that the learning outcome is achieved and it should involve excellent communications skills, careful design and the active involvement of the learners. Hence, this study provided valuable information in increasing learner's satisfaction by boosting their satisfaction and improving learning management system, that lead to implementing e-learning successfully.

This research has been conducted for art and design courses at FACA UNIMAS. The findings of students' perception on online teaching tools were presented and divided into three sections: (1) Students' perceptions of advanced online teaching tool for instructional methods, refer to Figs. 4 and 5. University has used different tools to serve its students in this COVID-19 period, such as Google Classroom, Zoom, Webex, and Microsoft Teams, in which this online software is commonly used by lecturer to present live sessions for delivering the lecture; (2) Students' perceptions of advance online teaching tool for learning activities refer to Fig. 6. The learning activities mostly used in the online platform for art and design students are Kahoot, Flipgrid, Padlet, Miro, Whatsapp, and Unimas eLEAP; and (3) Students' perceptions of advance online teaching tool for assessment strategies refer to Fig. 7. Poll Quizzes, Google Form, Quizlet, and Kahoot, are the most used apps or software by lecturers as assessment tools for online exam.

This research has aimed to measure students' satisfaction in the department based on the mentioned platforms and software. A survey questionnaire of Kurdistan *et al.* [23] in Likert style was adapted, which "1" means "I hate it" and "5" means "I love it", to collect the data on student's experience with all the mentioned online teaching tools used in the art and design courses. In additional to this, some open-ended questions are asked for each aspect of teaching instruction, learning activities and online assessment in the questionnaires, for example "Please state others online learning activities tools that you have experienced for online class?" and "Which online platforms and tools that you loved the most and state your reason?". These questions are essential for getting more details of information based on students' expectation and experience with the use of online teaching tools. As student-centered approach, it basically focuses on students as customers and universities required to improve their service quality in satisfying students and providing them with best educational services [24].

In the first aspect of online teaching tools used for

instruction (video conferencing meeting and presentation), the students' feedback and results are shown in Figs. 4 and 5.

Fig. 4 presents the students' experience with the online video conferencing tools with four software of Cisco Webex, Zoom, Microsoft Team and Google Classroom. The links for the meetings have been shared with the students through special groups that have been established in the social media. Based on the comparison and figure shown in Fig. 4, it is proved that most of the students (74.2%) were satisfied with the Microsoft Team meeting, while only 9.1% of the students were dissatisfied with it and 16.7% students have stayed neutral. Besides, it is also found that most of the students with 34.8% dissatisfied with the used of Google Classroom as online meeting tools. It showed only 18.1% of students were satisfied and 47% of students have stayed neutral.

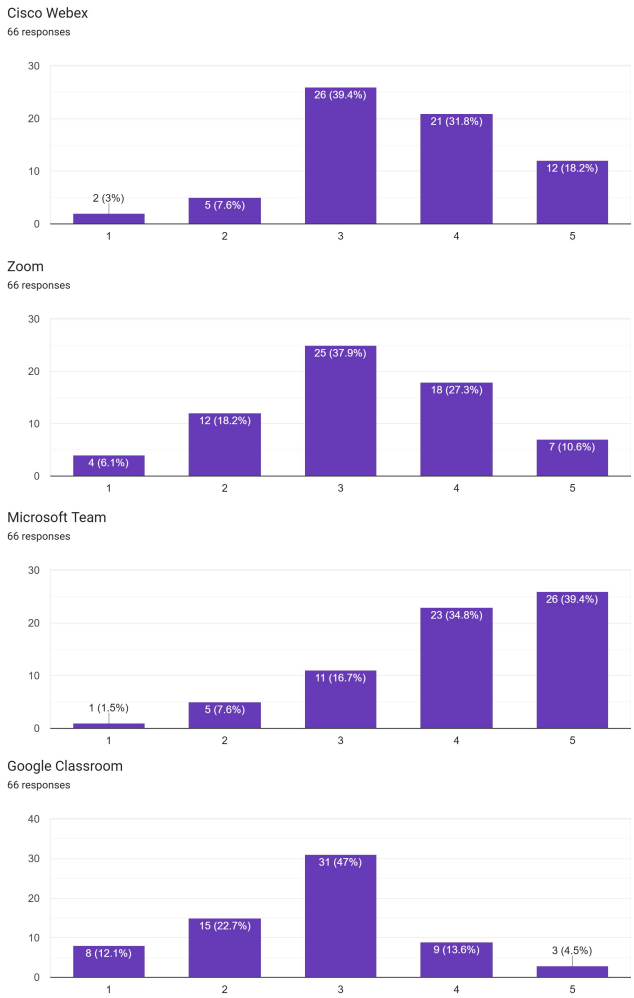

Fig. 4. Students' perceptions of online teaching tools used for instruction in video conferencing meetings.

The students added that they experienced using other apps for online meeting, for instance YouTube Live, Discord, Skype, and WhatsApp. However, there are some limitations with this software, so it is not so frequently used by the lecturers in their class. Based on the students' feedback, YouTube live is interesting as the students can lower the quality resolution of the live video to better suit their data or internet plan. YouTube live also allowed them continuous to attending and listen to the class without being cut off compared to others platform. In addition to this, the students can re-watch the class after the lecturing session to recap what they have learned previously. But the students also highlighted that YouTube live has its limitation as both lecturer and student is difficult to converse with each other. Lecturers cannot see and hear their students, it is hard to know who has participated in the live class. As a whole, the Microsoft Team software is the most preferred platform for students to have the online class for teaching and learning. According to them, Microsoft Team has equipped a lot of useful educational features and easy to use like whiteboards, recording function, screen sharing, privacy chat function, reminder calendar, space for assignment submission. It only needs minimal laptop or computer space to install and run the software. The most important thing from the students' concern, is Microsoft Team only need low bandwidth of internet data to access and join to the meeting room.

Furthermore, Fig. 5 showed the feedback of students regarding the online presentation tools that are commonly used by the lecturers in art the design classes.

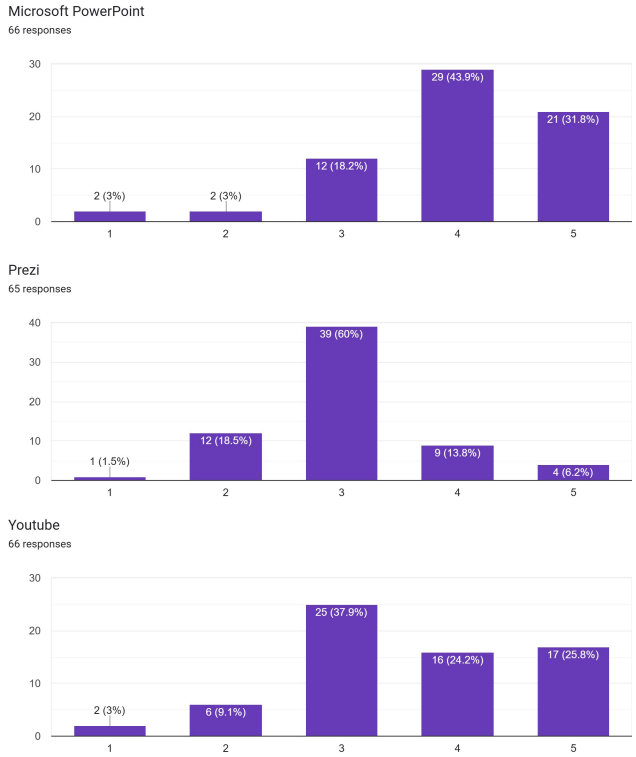

Fig. 5. Students' perceptions of online teaching tools used for instruction in giving presentation.

The responses from the participants indicated that they are leaning towards Microsoft PowerPoint compared to Prezi and YouTube as the presentation material from lecturers. According to the findings, most of the students were satisfied with the Microsoft PowerPoint with the result of 75.7%. The satisfaction is followed by YouTube with 56.2% and it is only 20% from Prezi. The students showed dissatisfied with Prezi with the highest percentage of 20% compared to YouTube of 12.1% and Microsoft PowerPoint with the 6% dissatisfied percentage. This result is also aligned with the students' perceptions on live sessions which compared with the offline videos in Table 3. It has been observed that the students want to have live session compared to use the pre-recorded video. Besides, the students also provide some suggestion that the lecturers also can use Canva, Jamboard, Kahoot, Milanote,

Vimeo, Google Slide, Loom, Miro, Whiteboard, Flipgrid and Padlet to deliver lecture. However, Microsoft PowerPoint is the most preferred software by the students because it is convenient to use, manage and easy to receive the information provided from the lecturer.

Apart from that, the satisfaction on online learning activities tools were also analyzed for the second aspect based on students' feedback from art and design courses. The respondent's result is shown in Fig. 6.

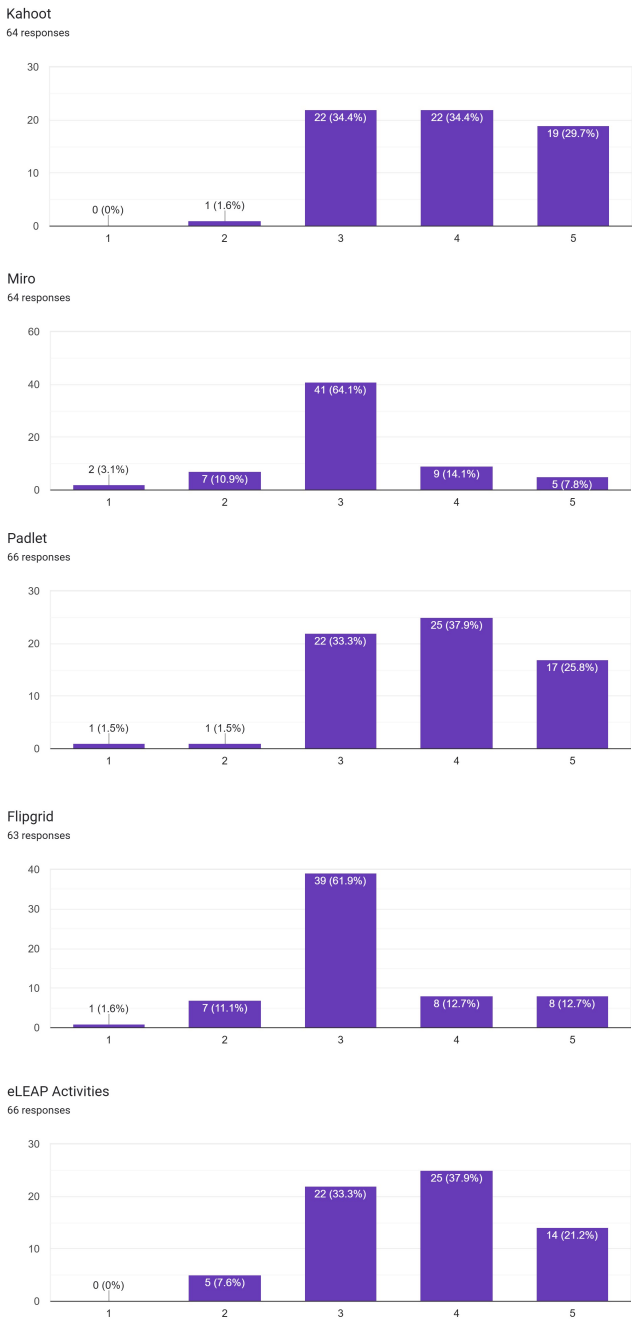

Fig. 6. Students' perceptions of online teaching tools used for learning activities in art and design courses.

Fig. 6 presented the results about the students' perception on online teaching tools used for learning activities in art and design courses. The results showed that 64.1% of the students were satisfied that the lecturer used Kahoot as the learning activities for art and design course. It followed by Padlet with 63.7%, eLEAP with 59%, Flipgrid 25.4% and Miro 21.9% that agreed and satisfied with the apps, platform and software used in the learning activities. However, the students have revealed their dissatisfaction with the online activities by using Miro with the highest percentage of 14% and followed by Flidgrid with 12.7% compared to eLEAP activities of 7.6%, Padlet of 3% and Kahoot with 1.6% of dissatisfaction. Based on the students' feedback, they loved to have fun activities during the learning process. They feel happy and engaged to compete with their classmates during the quiz's activities. They also suggested that the lecturer can use Khan Academy platform for learning activities, as it provides useful features and interesting informative videos. The exercises provided from this platform also give the students better understanding.

In the third aspect of assessment, Fig. 7 presented the students' perceptions of online assessment tools in art and design courses.

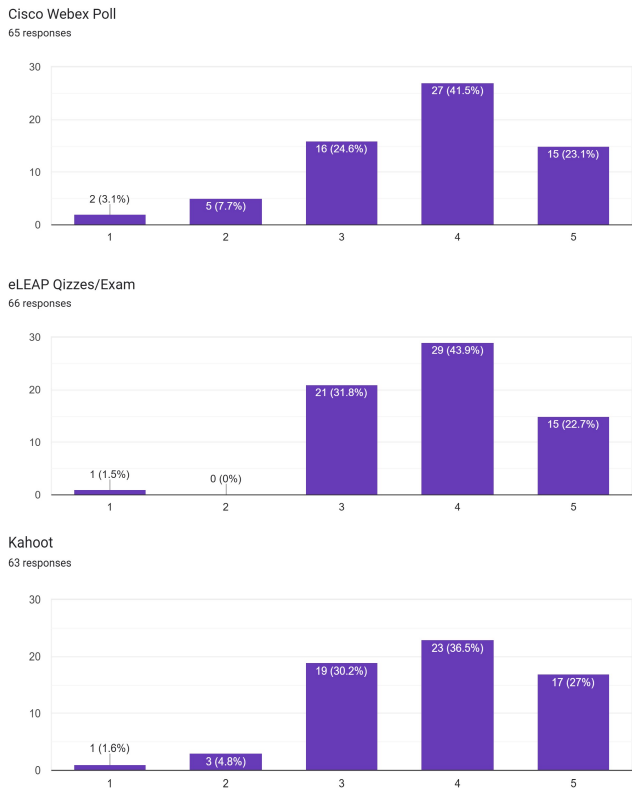

Fig. 7. Students' perceptions of online assessment tools in art and design courses.

Based on the above results, it proved that the students are more preferred to use the formal exam platform of eLEAP for the online assessment. The results showed the highest satisfaction percentage of eLEAP exam with 66.6% compared to Cisco Webex Poll of 64.6% and Kahoot is 63.5%. It can be observed that most students do not suggest using Cisco Webex and Kahoot for the online assessment. The reason is the eLEAP exams platform is safer, systematic and formal. In addition to this, most of the feedback received from the students highlighted that eLEAP is a more secure and convenient platform to use for online assessment.

V. Discussion and Conclusion

The research study was carried out to investigate student's expectation and perception towards online teaching tools in visual art education. Consequently, this finding of online

learning is possible as the core features that integrate the hologram as online tool for students in learning visual or art courses. To engage in valuable activities, holograms are considered, facilitating a mix of synchronous, asynchronous, online, and offline modes. It is to enhance the student's participation, engagement and not overloaded in order to reach the learning objective. Therefore, the online teaching tools that are used in three aspects of teaching contexts were studied, they are instruction, learning activities and assessment. The findings found that the students from art and design department likes to use Microsoft Team software to have the online class for teaching and learning. It is because this software is equipped with a lot of useful educational features and is easy to use by the students. However, the students emphasized that the Microsoft Team only need low bandwidth of internet data to access and join the meeting room. Furthermore, the students also expect more fun activities in online class. They loved to use Kahoot in the online class, and they felt happy and engaged to compete with their classmates during the quiz's activities with Kahoot platform. Moreover, the formal and more secure platform are more satisfied by the students for online assessment, such as eLEAP exam and quizzes created by UNIMAS. The feedback from students revealed that eLEAP platform is more secure and convenient to use for their exam.

Moreover, the findings have shown that the expectation on students with the use of online teaching and learning tools might be slightly different from the perspective of lecturers. Most of the lecturers think that the online tools used for art and design students must be more visual and 'live demo' to provide the information, especially in the practical training and teaching new skills. In fact, the students' feedback proved that they are more pay attention to the low bandwidth of internet data, the load of the software installed and run in their computer or laptop. Note that not all students are able to afford to have a big internet data for online learning. They also enjoy and engage with the fun activities in online classroom. Despite this, the interaction session between the lecturer and students also boosts the engagement of student's learning during the online class.

In brief, the study revealed significant insights into the integration of hologram features to enhance remote learning in visual arts education. Students demonstrated a strong preference for digital learning tools that are both easy to use and visually engaging. Hence, hologram technology, with its potential to create an immersive and interactive environment, effectively meets these needs, especially in the visual arts where hands-on experience is vital. It can be simplified as Fig. 8.

Overall, incorporating hologram features into online education offers a valuable opportunity to enhance the learning experience for art and design students. By providing engagement in valuable, immersive and interactive activities that combine both synchronous and asynchronous learning, students can engage with 3D models and virtual art pieces in ways that cater to their unique learning preferences. For example, virtual studio environments could allow students to engage with 3D sculptures or paintings in real time, facilitating immediate feedback and collaborative online learning.

Fig. 8. Hologram features to enhance distance learning in visual arts.

Apart from that, utilizing holograms for live demonstrations fulfills the essential need for visual and hands-on instruction in creative disciplines. An example could be a virtual classroom where instructors showcase techniques like digital painting or 3D modeling, enabling students to follow along and practice at the same time. While gamified learning experiences with fun and interactive assessments provide a more engaging and practical method for skill development. Such as holographic art contests or engaging quizzes, offer a more dynamic and effective method for skill development, making learning both enjoyable and practical.

Furthermore, ensuring that these advanced features are accessible even in low-bandwidth situations expands the availability of these tools to a wider range of students, regardless of their internet connectivity. For instance, optimized holographic tools could support participation in virtual art reviews or design sessions without requiring high data usage or experiencing significant delays.

On the other hand, enhanced interaction between instructors and students via holographic tools further promotes deeper engagement and more personalized learning experiences. This might include virtual office hours where students can receive customized feedback on their projects in a holographic setting. By prioritizing these key elements, educators can effectively leverage hologram technology to address the evolving needs of online education, leading to more impactful and enriching learning outcomes.

In sum, this research provides dependable insights into the potential of hologram features to enhance online education. Holographic technology has the potential to tackle numerous challenges by providing detailed 3D visualizations of student work, maintaining the subtleties required for precise assessment and feedback. These holograms also simulate hands-on experiences, allowing students to manipulate virtual objects realistically, which supports skill development. Moreover, holograms foster immersive and interactive environments that enhance social interaction and collaborative projects, even when students are physically apart. Such innovations ensure that art and design students receive a well-rounded and effective education during distance learning. However, this study has some limitations. While it examines the potential of holographic technology, it

does not address the actual implementation and long-term impact, which are essential for fully understanding the benefits and challenges of integrating this technology into online learning. Future research should include a more diverse sample, encompassing different universities, educational levels, and regions. Conducting longitudinal studies could help evaluate the long-term impact and effectiveness of holographic technology in online education. Additionally, experimental studies that implement and test holographic tools in real-world educational settings would provide concrete evidence of their benefits and challenges. Further research should also explore the cost-effectiveness and accessibility of such technology to ensure its feasible integration into various educational environments. Lastly, investigating the psychological and emotional effects of using immersive technologies like holograms on students would provide a more comprehensive understanding of their impact on the learning experience.

Conflict of Interest

The authors declare no conflict of interest.

Author Contributions

Loh Ngiik Hoon conducted the research and led the project. Natasha Binti Rusdy Wong analyzed the data and contributed to the interpretation of the results. Marzie Hatef Jalil coordinated the review process. All authors contributed to writing the paper and approved the final version of the manuscript.

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