

Text-based Discussion Environment using a Discussion Support System Enhances Participants' Engagement at International e-Conference: KICSS 2020 Online Experiment

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1 ABSTRACT

With the adverse effects on the global Coronavirus Pandemic on travelling, the scientific community has developed many tools to create a joint solution towards an environment that supports productive collaboration online. Thus, many scientific conferences in 2020 were conducted virtually, particularly using video-based communication such as Zoom. However, transition to these unconventional platforms posed challenges for conference related activities such as networking and intensive group-based discussion. To address these problems, online interactive discussion tools that support both text and video based discussion have become so essential. Towards this end, in this paper, a well-established conference on creativity in science and technology, called KICSS 2020, conducted a virtual experiment using blended approach with a video-conferencing platform, Zoom, and a text-based discussion platform, called D-Agree. This method of using joint solutions to host conferences is envisaged to support conference related activities mentioned before, and to study performance metrics within used environments during Q&A session in order to suggest an effective environment that might help to positively change collaboration among participants in the future. This study purports the first-ever to compare the effectiveness of online text and video-based communication tools during a research Q&A session while hosting an international conference in a synchronous virtual venue. The experimental results show that there was a statistically significant difference in the participation type and its engagement rate of conference attendees in Zoom and D-Agree. The findings give credence to the viability of the D-Agree as a tool for active participation (participation with discussion) because of its relative low psychological costs and ease of use during Q&A sessions, while Zoom is more suitable for attracting passive participation (participation without discussion). Furthermore, the lessons learnt through organising this event and analysed results might offer a promising prospect that could enrich the hosting of virtual conferences, using blended approaches for both scientific and educational purposes in the future.

Keywords: online participation, discussion system, Civic engagement, Virtual conference, Online discussion

2 INTRODUCTION

2.1 Introduction and background of the study

On March 11, 2020, the World Health Organization (WHO) declared the COVID-19 a global pandemic, and in the weeks that follow, many countries issued a stay-at-home order. In more than 172 countries, the COVID-19 Pandemic had completely driven teachers and students from physical classrooms into Internet virtual classrooms. Indeed, since then online classes have become the new normal, and integrated into the educational information delivery methods of many universities around the world (Aihara et al., 2020). For example, Figure 1 shows that the total number of learners impacted by the Pandemic surged to more than 215 million as of May 20, 2021. This represents a decrease in the figure of impacted learners between March 25, 2020 and April 27, 2020, which stood at 1500 million. However, to mitigate the impact, schools increasingly embraced a hybrid mode of education, using both conventional method and a virtual delivery of educational information, using e-learning platforms and tools. This hybrid mode of delivery educational instructions is expected to outlive the COVID-19 Pandemic, but what online tools (video-based, text-based or video and text-based) hold the most mutually beneficial outcomes to their educational institutions or conference organisers and end users (students and conference participants) remains a puzzle that needs to be unravelled.

Similar to educational activities, the COVID-19 Pandemic led many conference organisers to the decision to cancel face-to-face events and moved them to online platforms, using various tools (Bonifati et al., 2020). These tools were used to support conferences activities (such as networking and presentation) (Jarvis et al.,

2020) with a view to enabling participants to jointly listen to presentations, engage in live Q&A and attend other events associated with conferences. These online platforms, which utilise various features and support to host quality virtual events have gained significant attention since the outbreak of the Pandemic (Haqbeen et al., 2020a). However, since conferences have traditionally provided a platform for networking, information exchange, and intensive group-based collaborations, using video-conferencing tools such as Zoom may not be able to support all conference activities on its own. For example, interactions and discussions, which are key features of conferences, particularly during Q&A sessions may be as effective as those in conventional conferences, using only video-based applications.

Conference organizers managed to address this shortcoming to a reasonable extent by adding text-based interactive platforms such as LinkedIn as joint solutions to support conference activities (Haqbeen et al. 2020c), thereby facilitating interesting discussions during the Q&A sessions which often follow presentations. With better preparation and support tool, they believe that greater interaction can be fostered, using joint environments (video-based and text-based).

Therefore, a joint solution (video-based and text-based) online platform(s) requires interactivity that can provide more opportunities for networking (Boureal et al., 2020). Therefore, a good online conferencing should take into account the advantages associated with combining both. Based on this, online conferences might be better positioned to employ digital services and tools for presentation and collaboration than physical events. Thus, many conferences used at least two online platforms: (a) video conferencing applications such as Zoom as the main tool (Zoom Video Communication Inc., 2016), and (b) online interactive platforms such as Gather town, underline, hopin, LinkedIn and D-Agree as extra interactivity tools. This study is guided by the following two questions. First, what effect does the introduction of a text-based interactive platform have on promoting interactivity in online Q & A research sessions while using a video conferencing tool? Second, between video-based and text-based discussion tools, which is more effective for facilitating interactivity based on the performance metrics of conference participants during Q & A research sessions?

In this paper, we share our experiences of organising an international conference, which was planned to take place in Tasmania, Australia. However, the rapid spread of the COVID-19 Pandemic led to the cancellation of the face-to-face event and in its place, an online conference was organised, using two platforms, Zoom and D-Agree, as a blended solution to support the conference activities. We also discuss our assessments of the potential usefulness of these tools for collaboration and networking during conference Q&A sessions. The lessons learnt through organising this event and comparing these platforms provide an outlook that could enrich using blended text and video-based approach to host virtual venues for both scientific and educational purposes in the future. To the best of our knowledge, no previous study has examined, explored or conducted experiments, which focused on differences in the participation and discussion metrics of video conferencing tools and text-based discussion platforms in an international conference.

Figure 1 shows the global monitoring of school closures caused by the COVID-19 Pandemic.

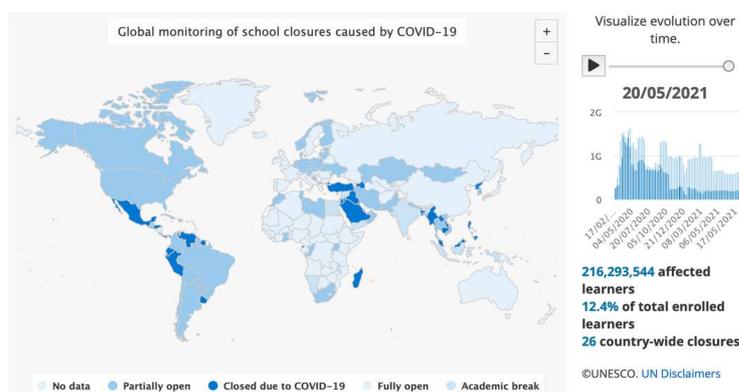


Fig. 1: Global Monitoring of school closures caused by COVID. Retrieved on May 20, 2021 from <https://en.unesco.org/covid19/educationresponse>

2.2 Authors' experiences from virtual conferences and their adopted tools

Due to the COVID-19 Pandemic, many scientific conferences in 2020 were conducted in the form of virtual events (Boureau et al., 2020), which posed a great challenge for conference-related activities. Organising a

scientific event, specifically a conference, involves various tasks before, during and after the main sessions. Broadly, those activities can be categorised into: (1) networking (introduction and exchange of opinions among participants); (2) presentation (presentation of position papers followed by question-and-answer session); (3) collaboration (social events to stimulate collaboration among participants) and (4) organisation (schedule preparing, reviewing, wrap-up and post-conference activities). Networking is probably the most adversely affected by this transition from conventional conferences to online ones, as the former typically provided a forum for information exchange, and intensive group-based collaborations. However, conducting conferences virtually presents inevitable barriers to experiencing full-fledged, in-person interactions and exchanges with colleagues (Boureau et al., 2020), although virtual formats also have some unique advantages. For example, there is no budget for travelling to participate in virtual conferences, making them more accessible and convenient for a broader range of interested participants.

In this section, we reflect on our experiences in six virtual international conferences that we participated in since last year (2020). These conferences, which were hosted on different platforms aimed to provide participants with experiences similar to in-person meetings (physical conferences) while making use of a digital online service for group collaborations. In particular, we elaborate on the tools used, as well as their advantages and disadvantages attached to the events attended.

We attended as correspondent authors and presented our research works in six international conferences between 2020 and 2021, namely; AAMAS 2020, JSAI 2020, ACM CI 2020, WI-IAT 2020, IJCAI-PRICAI 2020 and GYSS 2021. Initially, all these events were scheduled to be held as in-person events in Auckland, New Zealand; Kumamoto, Japan; multi-sited Copenhagen, Netherland and Boston, USA; Melbourne, Australia; Yokohama, Japan and Singapore, respectively. However, due to the pandemic, the venues were moved fully to virtual venues, using online platforms and tools. The first conference which we attended virtually was the International Conference on Autonomous Agents and Multi-Agent Systems (AAMAS), 2020. The conference was initially scheduled to be held in Auckland, New Zealand between May 9 and 12, 2020, but was eventually hosted on virtual platforms (Underline and Zoom to be specific). Underline is the world's first digital library and virtual conference streaming venue for scientific events (Underline Science, 2021). The virtual conference venue, Underline, included participants' pre-recorded presentations, so interested participants can watch it in their spare time, while the full presentation was hosted on Zoom. Zoom is a collaborative, cloud-based videoconferencing service, which offers features such as online meetings, group messaging services, and secure recording of sessions, used by most online conferences as virtual venues. However, the major observations made by the authors during the conference was that there was limited time, which made it difficult for several participants to collaborate and discuss with other participants during Q&A sessions and networking events.

Our second experience on online conference was the 34th Annual Conference of the Japanese Society for Artificial Intelligence (JSAI), 2020 (Haqbeen et al. 2020b). This second conference was scheduled to be held in Kumamoto, Japan from June 9 to 12, 2020, but was also moved to a virtual venue. Due to the COVID-19 Pandemic and the subsequent state of emergency that followed in many of Japan's prefectures, the organisers decided to host a full virtual conference, using Zoom. Like the first conference, the authors observed that there was no interactive platform for networking and the time allotted to the Q&A session was also limited.

Our third experience was with The Association for Computing Machinery Collective Intelligence Conference (ACM CI), 2020 (Haqbeen et al. 2020c). ACM CI was initially scheduled to be the first multi-sited international conference to be held in Copenhagen, Netherland and Boston, US. on June 18, 2020, but was also changed to a virtual venue, using three virtual tools, namely; Zoom, LinkedIn and YouTube. Zoom was used to host the full presentations in real-time (synchronous), while Zoom streamed, using Youtube service was used to expand the coverage out of Zoom's website. By fully synchronous, we mean that participants jointly listened to presentations, had live Q&A, but with limited time constraints. The conference organisers created a LinkedIn group and posted all accepted papers in the conference's link on the platform, so interested participants could read and post their questions in their spare time during the conference. Then, the corresponding author(s) of the papers could reply to those posted questions. This resulted in participants' inactivity, especially regarding networking. Moreover, since this kind of participation is often passive and devoid of active interactions among relevant participants, it often results in inaction and lack of initiatives to engage in networking. Similarly, the disconnect amongst participants led to the proliferation of uncoordinated networking.

The fourth conference which we attended virtually was the 19th IEEE/WIC/ACM International Joint Conference on Web Intelligence and Intelligent Agent Technology (WI-IAT '20), 2020 (Haqbeen et al. 2020a). Similar to the conferences discussed above, the 19th IEEE/WIC/ACM conference which was initially scheduled to be held in Melbourne, Australia from December 14 to 17, 2020 was moved to a virtual platform and hosted on Zoom. The authors also observed that there was no interactive platform for networking, which resulted in participants' inactivity.

The fifth conference in which we participated was the 29th International Joint Conference on Artificial Intelligence and the 17th Pacific Rim International Conference on Artificial Intelligence (IJCIA-PRICAI), 2020 (Haqbeen et al. 2020d). The IJCIA-PRICAI conference was originally scheduled for July 11 to 17 in Yokohama, Japan. Like other AI conferences, the COVID-19 Pandemic disrupted the proposed physical gathering, thereby compelling the organisers to reschedule the conference to a virtual venue between January 7 and 15, 2021. The conference was hosted on Zoom and Gather.Town. The Gather.Town bolstered the efficiency and effectiveness of the events by stimulating interactions among participants. The organisers used both text and video communication on a large-scale. However, the virtual venues faced many challenges during the event, as the links went down, resulting in scalability challenges.

The final event which we attended was the Global Young Scientists Summit (GYSS2021). This summit was initially scheduled to be held as a conventional physical gathering, but was later hosted on a virtual venue, using Hopin. Although the Hopin (Hopin 2021) networking feature has the potential to broaden participation, during interactive sessions (networking), it may not support large-scale interactions, unlike the one-to-one communication.

3 OBJECTIVE AND METHODS

3.1 Research objective and Hypothesis

The purpose of this study is to examine the effects of video-based and text-based tools on the performance metrics and interactivity of participants during Q & A session in online conferences/platforms.

To address the time-related or temporal and spatial obstacles in virtual venue tools, particularly during Q&A sessions, we conducted an exploratory experiment by setting a joint video-text virtual venue tool as a hybrid solution to support conference activities. In this way, we aimed to create an environment that is conducive to active participation (participation and discussion) activities. In light of the advantages of using multi-sited environments to increase active participation levels, we examined the following hypotheses:

H1: Using text-based discussion environments enhance the degree of active engagement during Q&A sessions.

H2: Participants who desire to express opinions are more active in text-only discussion than video-based forum. Hence, the threshold for expressing opinion in a text-based can be lower than that in a video discussion forum.

H3: Participants are more likely to express/exchange a wide-ranging opinion in a text-based discussion than in a video discussion forum. It is assumed that text-only discussion enables low psychological cost that video-based conversation.

The objectives of the study are to ascertain the performance metrics of text-only discussion and video-based forums in terms of stimulating engagements in Q & A sessions during a two-day conference period.

3.2 Method

This research is part of a broader study, which explores the effectiveness of discussion platforms in hosting virtual events, such as town meetings (Haqbeen et al., 2020a), online COVID-19 discussion (Haqbeen et al. 2021c) and online conferences.

We initially intended to host a conference by creating an efficient environment and using joint solutions to study the performance metrics of participation and discussion within each tool based on participants' subjective assessments of the participation and posted opinions. The sample of the study comprises 27 participants who consecutively participated in two-days conference, using both Zoom and D-Agree. The study is based on data from the "Q & A sessions" of the above-mentioned conference. All participation via Zoom was video recorded, while that of D-Agree was retrieved as discussion annotation dataset files. Statistical

analyses were conducted to ascertain the differences in arithmetic means and standard deviation, using STATA analytical software version 16.

All corresponding authors whose papers were accepted at KICSS 2020 and who registered for the conference were requested to participate on two platforms. Our initial approach was facilitated through conference chairs and organisations which were interested in identifying an efficient virtual environment that could enhance participant engagement in activities within virtual venues. This was to be followed by a convenient strategy, using participating conference attendees.

3.3 Study Area

The 15th International Conference on Knowledge, Information and Creativity Support System (KICSS) which was initially scheduled to be organised by the School of Technology, University of Tasmania, Australia from November 25 to 27, 2020, was moved online and held between November 25 and 26, 2020. The KICSS aimed to intensively facilitate technology and knowledge exchange amongst international researchers/scholars in the field of knowledge science, information systems, system science and creativity support systems. The conference covered a broad range of research topics which cut across the fields of knowledge engineering and science, information technology, creativity support systems and complex system modelling. Although the conference was moved online, the organisers made efforts to preserve as much of real-life experiences as possible. Two authors of this paper functioned as the general and online chair persons, respectively. The conference was delivered virtually, using Zoom, as the video-conferencing platform while D-Agree was used as a discussion support platform. We tried our best to convey the in-person experiences in a multi-sited setting.

The paper submission deadlines for KICSS was August 31st, 2020. 29 full papers (based on average length and contents of the articles) were submitted to the conference. This figure was lower compared to the submissions received by the same conference in 2019. This decline in the number of articles (papers) submitted to the conference may have been informed by the COVID-19 Pandemic, leaving us with total of 27 submitted papers which represent the sample of this study ($n = 27$). This figure seems more like the size of a symposium rather than a conference where several hundreds of persons usually participate. The main contact authors were from 5 different countries. The majority of the submissions was from Japan (52%), followed by China (24%) while the remaining 24% was from three other Asian countries: Afghanistan, Taiwan and Pakistan. The Technical Programme Committee which reviewed the various submissions consisted of 27 experts from different parts of the world. The review meeting took place online on October 3rd, 2020. The committee accepted 16 regular papers (~55% acceptance rate) and 11 short papers (~37% acceptance rate). The attendance at KICSS 2020 consisted of 27 correspondent authors and 12 other attendees. There were four experts who were invited from Australia, Japan, Thailand and USA to talk about various issues related to the theme of the conference.

The size of the previous KICSS conferences ranged from 80 to 150 attendees, which qualifies it to be a small/medium conference (according to IEEE and ACM standards) that can be accommodated using the Zoom meeting and discussion support platform. However, for this study, we used a Zoom webinar. More details about the instruments used for this study will be discussed in Section 3.5.

As the size of the KICSS 2020 was relatively small ($n = 39$), it allows us to provide live presentations, using Zoom. We believed that live presentations will create more activities and attract more interactions than recorded videos. To keep the programme within the time frame that is acceptable to the majority of attendees, we asked the authors of the accepted full and short papers to prepare a 30- and 15-minute slide presentation, respectively. We created 27 virtual spaces for each corresponding author on D-Agree, and then, the authors were asked to create their accounts on D-Agree and upload their slides. Each author's virtual space could be accessed by all registered attendees on the days of the conference. Each author of a full and short paper (manuscript) was expected to make a presentation lasting for 25 and 10 minutes, respectively during the live session of the conference, using Zoom. Another 5 minutes was allotted to Q&A at the end of each presentation, so that the audience could interact further with the presenters/authors. Similarly, an open Q&A session followed the presentation on D-Agree. The audience was given opportunity to ask questions during the live session and were allowed 5 minutes to do that or post questions on the corresponding presenters/authors' virtual space during the live session of the conference.

As a result,, we were able to restrict each session to between 80 and 90 minutes. Day one of the conference started at 10:30AM and ended at 5PM. JST time. The award ceremony and social event started at 6PM and ended with a virtual social event (live music) at 9PM. We observed that the attendance was always above 18 and 8 attendees at any moment of the day throughout the entire programme on ZOOM and D-Agree, respectively. However, the participation was not quite steady on both tools. The two-days conference programme and presentation slots in each session are shown in Figure 2.

ZOOM-D-Agree (Virtual Hybrid) Japan Time (UTC+9) Thailand Time (UTC+7) Australia Time (UTC+11)	ZOOM 1 ID: 712 166 2793 Passcode: room2020	Zoom 2 ID: 853 8247 8586 Passcode: room2020	ZOOM-D-Agree (Virtual Hybrid) Japan Time (UTC+9) Thailand Time (UTC+7) Australia Time (UTC+11)	ZOOM 1 ID: 712 166 2793 Passcode: room2020	Zoom 2 ID: 853 8247 8586 Passcode: room2020
	D-Agree Discussion Code: kicss2020			D-Agree Discussion Code: kicss2020	
	25th November			26th November	
10:30 - 10:40	Opening		10:00 - 11:30	Session 4: Idea Evaluation and Innovation	
10:40 - 12:00	Session 1: Creative research environments and their performance	S1-1 S1-2 S1-3 S1-4	11:30 - 13:00	Lunch time	
12:00 - 13:00	Lunch time		13:00 - 13:50	Invited Talk 3: D-Agree: Crowd-scale Consensus Support System based on Automad Facilitation Agent Prof. Takayuki Ito	
13:00 - 13:50		Invited Talk 1: AI in Medicine Dr. Sanparith Marukatat	13:50 - 14:00	coffee break	
13:50 - 14:00	coffee break		14:00 - 14:50	Invited Talk 4: The AutoCoach Smart Agent Project: AI with a Personality Prof. Kwei Jay Lin	
14:00 - 15:20	Session 2: Online Discussion and Cooperation	S2-1 S2-2 S2-3 S2-4 S2-5	14:50 - 15:00	coffee break	
15:20 - 15:30	coffee break		15:00 - 16:30	Session 5: Education and Support	
15:30 - 17:00	Session 3: Machine Learning and Creativity	S3-1 S3-2 S3-3 S3-4 S3-5; T3-6	17:00 - 17:30	Closing: KICSS2021 Next host presentation	
17:00 - 17:50		Invited Talk 2: Agent-based Influence Propagation Modelling: Methods and Applications Prof. Quan Bai			
18:00 - 21:00	Award Ceremony/ Social Event				

Fig. 2: A Two-day Programme of KICSS 2020 hosted virtually on ZOOM and D-Agree.

3.4 Participants

The participants were from 8 different countries, which comprise correspondent authors (n = 5), and other attendees (n = 3). Eighteen (52%) participants were from Japan, making it the most represented country in KICSS 2020. This was followed by participants from China (n = 7; 24%) while the remaining 24% were from three Asian countries (Afghanistan =2; Pakistan =1; and Taiwan =1). The other 10 attendees were from Australia (n =1), Japan (n =7) Thailand (n =1) and the United States (n =1). The participants were signed up on Zoom (n =39) and D-Agree (n =33) based on their availability and consent to participate in the research during the KICSS. However, based on the authors' decision, we considered only attendees who were registered as correspondent authors (n =27), and consecutively participated in the five sessions of the twodays conference. We excluded the data of the 12 attendees who logged in, but were not present during the two days conference by our research team. Note that 27 participants who logged into Zoom and created accounts on D-Agree and engaged in online activity on the platform at least once as well as responded to one another during KICSS, using both Zoom and D-Agree were part of this study. The convenience data collection procedure was applied to collect the required data. 22 (74%) of the selected participants were males while 7 (25.9%) were females. Based on their levels of education, 6 (22.2%) of them were postdocs or PhDs, and 5 (18.5%) were PhD students, and 16 (59.2%) others were master students. The ages of the participants ranged from 22 to 65 years.

3.5 Instruments

Zoom and D-Agree were the main instruments used for this study. Zoom is a video-conferencing platform on the internet that allows two-way synchronous method of audio and video communication. It is also known as Voice over Internet Protocol (VoIP) mediated technologies like Skype and FaceTime (Zoom Video Communications, Inc. 2021). It is a collaborative, cloud-based video-conferencing service, which offers features such as online meetings, group messaging services, and secure recording of sessions. It has become a very popular video-conferencing tool since the outbreak of the COVID-19 Pandemic, as its virtual platform provided a substitute for academic exchanges and business transactions outside their conventional settings.

On the other hand, the D-Agree (Ito et al., 2020) is a text-only discussion-processing platform, which is based on artificial facilitation (Hadfi et al., 2021) on the internet. The D-Agree allows for a large-scale synchronous and asynchronous method of text-based communication. It is used to host virtual meetings by

gathering, facilitating, extracting, and visualising real-time discussion summaries. Technically, the system provides a vehicle that facilitates crowd-scale interactive deliberations to promote text-based discussions.

3.6 Procedure

We conducted the experiment in the KICSS 2020 conference's five main sessions, which had 27 presentations spread across twodays between 10:40AM and 17:00PM on 25 and 26 November, 2020, respectively.

We decided to run the event as a joint live mode to simulate Q&A sessions as much as possible. This was achieved by combining the webinar on Zoom video conference software with the D-Agree text-based discussion support platform. In line with the sessions of KICSS 2020, we decided to make the programme single track with five sessions, so that participation on Zoom and D-Agree could be simultaneously used during each Q&A session. Presentations on each session took place on Zoom webinar for each of the planned sessions, with an ID and password provided to attendees. Our five sessions generally spanned 80-min (n =2) and 90-min (n =3) with the net talk length for each full-length paper being 25-min (n =16) while a short paper (n =11) was 10-min. A 5-minute Q&A session followed each presentation to allow the audience to interact with the presenters on Zoom and D-Agree. The discussion experiment was conducted during the Q&A sessions, using Zoom and D-Agree. Although Zoom offers two modes of online interactivity, the meeting and the webinar modes, the latter was used in this study. The webinar mode has a text-based Q&A facility that allows participants to type their questions and to upvote questions asked by other participants (Bonifati et al., 2020).

The process started with an open call for participation and forwarding of the Zoom passcode and D-Agree discussion space code to all registered attendees. We created a virtual discussion room within one virtual discussion space for each of the 27 presentations based on their session slots. This setting on D-Agree allowed us to connect the ID of each presenter's virtual discussion room with the recorded Q&A session presentations and discussions of participants on Zoom.

Participants logged into Zoom and D-Agree via their own personal computers or smartphones to participate in the KICSS virtual conference. They then created their accounts on D-Agree, using their email addresses. We asked the participants to use the same name that was registered in KICSS for this purpose to avoid anonymous discussion and facilitate genuine networking. The participants used their IDs and passwords to log into D-Agree and to post the start-up message: "Hello everyone. This is [author name], the author of the paper [correspondent paper ID] from [affiliation]. Thank you for taking interest in our work. I am happy to take any questions and address your comments about the content on the paper. Thank you!". We asked all correspondent authors to post their start-up message and upload their slides on D-agree platform from 11 to 24 November, 2020. All presentations across the five sessions of KICSS was conducted in English.

The presentation slides were uploaded to each presenter's virtual discussion room. Based on their preference, attendees could join these rooms. In addition, all presentations were streamed-lives on D-Agree Facebook page link: <https://www.facebook.com/DAGreeAFG/videos/372974633939103>.

All the participants were allowed to ask video and audio-based questions on Zoom during synchronous Q&A session or could post a text-based question/argument on Zoom chat or D-Agree during each synchronous or asynchronous research presentation session.

Participants jointly listened to presentations, had live (synchronous) Q&A on Zoom and (a/synchronous) D-Agree, and attended other live events associated with the conference. Note that synchronous means that attendees can ask orally or post their questions in live mode, while asynchronous here means that they can post their questions once the presentation has finished but within a specific session and conference time. In other words, fully synchronous Q&A entails those online presentations could be watched by participants while simultaneously participating in the Q&A session during presentations in live mode. On the other hand, asynchronous Q&A on D-Agree requires participants to post comments and opinions during the conference session that best suit them.

We recorded the participants performance metrics (participation and discussions) during each Q&A session on Zoom and stored the discussion datasets files on D-Agree during the twodays conference. We also stored the questions and answers on Zoom chat. However, there was no text messaging during Q&A session on

Zoom chat. For this study, to enable us compare participation and discussion on Zoom and D-Agree, we only considered the data (video and text) called and posted during Q&A sessions on both platforms.

The user interface of D-Agree during our experimentation is shown in Figure 3. We used the following functions of D-Agree: display of discussion phases (1. divergence; convergence; evaluation; and conclusion), display of ranking, and display of discussion in tree structures. However, in this experiment, we adopted divergence phase since we were interested in collecting a diverse opinion from participants (Haqbeen et al., 2021a).

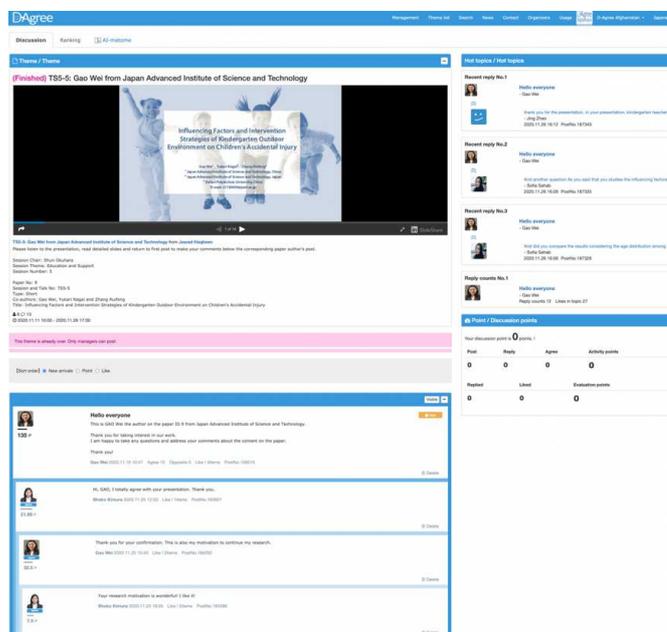


Fig. 3: User Interface of D-Agree during discussion on S5-5 Q & A session

3.7 Data analysis

For the analysis of participants' engagement, we used the footage from the recorded and stored Zoom chat, and the annotation files of each discussion space on D-Agree during each Q&A session. We used the following features of Zoom: Webinar and text-based Q&A facility. On the other hand, we used the following functions of D-Agree: divergence discussion phase, display of reply (including agree and opposite features), and "like" button. Since it was not necessary to converge opinions during the discussion phase at KICSS, only the divergence phase was used for this session.

For the indicator of engagement (participation and discussion) on Zoom, we analysed the following items from participants' logs in and posts on Zoom during the Q&A session of each presentation: the number of users who logged into the platform; the number of video-audio posts (including questions, answer and arguments); the number of characters in each post; and the number of Zoom chat (including questions, answer and arguments). However, as mentioned in Section 3.6, there was no text messaging during Q&A session on Zoom text-based Q&A facility.

For the indicator of engagement on D-Agree, we analysed the following items from participants' logs in and posts during the Q&A session of each presentation: the number of users who logged into the platform, the number of "likes"; the number of posts (including questions, answer and arguments) and the number of characters in each post. Although the discussion datasets and files included other items, which we intend to explore further in a different study, for this study, we restricted our analyses to the items mentioned above.

The mean scores of participations and discussion on Zoom and D-Agree were analysed, using t-test for comparative purposes. To analyse participation and discussion on Zoom, we watched the video recording of each presentation and listened carefully to all the Q&A sessions within each paper. These steps were followed by the transcription of the discussions. This enabled the authors to quantify and compare the means of participation rates and the frequency of engaging in discussion by the participants across the attributes mentioned above on Zoom and D-Agree platforms.

To analyse the Q&A discussion on D-Agree, we downloaded the discussion annotation file of each presentation from the system. The annotation files consisted of the number of participation (users who logged into the platform), post, reply, time, points etc. Since it was not necessary to analyse all the discussion annotation datasets, with respect to the performance metrics, only the number of users whologged in, the number of likes, the number of posts (including replies) and the number of characters were used in this study.

To ascertain if there is a difference in the participation and number of posts on Zoom and D-Agree, we compared their rate of participation and frequency (rate) of expressing their opinions, using t-test on both instruments. We then analysed participation and discussion for each tool. To examine the validity of the analysis of the annotated discussion data within both tools, we used mean values of the parametric tests.

4 SETTING

We set up a discussion room for each correspondent author on Zoom and D-Agree before the commencement of the conference, so that each paper would get both a presentation spot on D-Agree and a dedicated time spot on Zoom. We used

session for the video and audio-based interactions. The access could be controlled through the Single Sign On (SSO) on Zoom and a discussion space on D-Agree, so that only attendees of KICSS 2020 who registered and logged in could enter the Zoom and D-Agree virtual venues. We decided on joint solution, using both Zoom and D-Agree. Each paper got both a presentation spot on D-Agree and a dedicated time spot on Zoom. The basic idea behind this hybrid setting was to support conference activities, particularly the Q&A sessions. We aimed to compare the participants' engagement and their performance metrics (participation and posts) while looking at the number of those who logged in and posted messages during the Q&A session.

5 RESULTS AND DISCUSSIONS

The results of the analysed data on the participation and discussion on Zoom and D-Agree are summarised in Table 1 while the comparison of the number of times participants logged in during the online discussions, using Zoom and D-Agree during Q&A session is shown in Figure 4.

Based on the analysed results for participant engagement during the Q&A sessions, using both instruments (Zoom and D-Agree), the levels of engagement of the participants differed based on their number of participation (e.g., the total number of participants times participants logged in during the sessions), and engagement (e.g., the total number of postings by participants during the sessions). The total number of times participants logged into Zoom platform was $n = 550$, Mean = 20.37, SD = 3.49, while the overall number of participations in all sessions on the D-Agree platform was $n = 130$, Mean = 4.92, SD = 1.85. The frequency of participation and their corresponding mean scores for all the sessions were higher on Zoom ($n = 550$; $M = 20.37$) than the frequency of participation and their corresponding mean scores on D-Agree ($n = 133$; $M = 4.92$; $SD = 1.85$). The findings suggest that people engaged and participated more on Zoom than on D-Agree due to the video-based benefits as well as the convenience and interactivity offered by the former. On the other, the D-Agree is a text-only discussion platform, which does not support video-based communication. However, the participation on Zoom was often passive because participants seldom engage in active discussions and without active discussions, genuine participation cannot be sustained (Haqbeen et al., 2021).

The average number of posts (including questions and answers) during Q&A sessions on Zoom were ($n = 75$, Mean = 3, SD = 1.6) compared to that of D-Agree which was ($n = 237$, Mean = 9, SD = 7.8). The number of engagements (posts) and their mean scores for all sessions were higher on D-Agree ($n = 237$; $M = 9$) than those on Zoom, which were ($n = 75$; $M = 3$), respectively. The findings suggest that due to the text-based discussion benefit offered by D-Agree and its convenience, people tended to be more engaged, judging from their number of postings than on Zoom. This may have been informed by the limited time allotted to the Q&A sessions. It may also reflect the participants' hesitant psychological disposition towards video-based discussions compared to text-based online environment. The frequency of participation and posts on each presentation are shown in Figure 3. The presentations are labelled as session [S]; number of sessions [1-5] and number of papers [1-7].

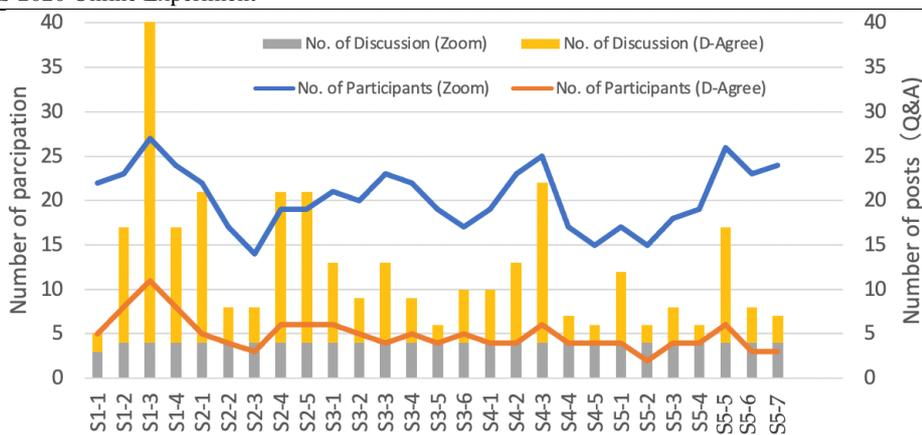


Fig. 4: Distribution of participants and posts for each presentation on Zoom and D-Agree: sessions labelled as S1-S5 and their corresponding paper presentations labelled as numbers for each session respectively.

We also compared the number of characters posted on Zoom (transcribed) and D-Agree and their corresponding mean scores. The overall number of posted characters and their corresponding mean scores on D-Agree (n =50,073, M =210.39) were higher than those of Zoom (n =14,422; M =192.29) during Q&A sessions.

In addition, the study also found a significant difference between the number of characters posted on Zoom and D-Agree on women discussion spaces. Further analysis revealed that there was a statistically significant difference between average number of characters posted on Zoom (n =22029, M =286.09) and D-Agree (n =10717; M =206.09) in women discussion spaces.

Surprisingly, the highest average number of characters on D-Agree was submitted on woman discussion spaces (n =22029; M =286.09), while the highest average number of characters on Zoom was submitted in men discussion rooms (n =10717; M =206.09).

The number of posted characters were also compared between genders. The number of characters submitted in woman discussion rooms on Zoom was lower (n =3873; M =168.39). These findings suggest that text-based discussion environment may be more user-friendly, particularly along gender divides.

The results of the analysed data on the participation and discussion, using Zoom and D-Agree are summarised in Table 1.

5.1 Discussion

We anticipated that by using an online video-conferencing tool, Zoom, and discussion support platform, D-Agree, we might be able to replicate the experience of face-to-face conference. We also anticipated that such an online platform combination would allow participants to achieve a collaboration through both text and video-based networking. This informed our belief that Zoom would be a feasible method for hosting presentations while D-Agree would be feasible for Q&A session, networking and collaboration.

The experimental results show that participants took part in Zoom discussions, but their rate of opinion solicitation, as differentiated by questions and answers during the Q&A session was lower than the number of posts on D-Agree. Indeed, some previous studies (see Haqbeen et al., 2021a) have shown that this type of participation might be passive, but without active discussion participation cannot be sustained.

These findings could provide a guide to organisers of virtual venues, particularly those related to scientific events on how to facilitate better and more interactive sessions during conference activities such as Q&A and social networking sessions. Moreover, the findings give credence to the potential of such a blended approach, which combines text-based discussion platform and video-conferencing application to stimulate greater participants' engagement in virtual venues. Text-based environment is particularly important for enhancing collaboration and networking, as some reported in previous studies (Haqbeen et al. 2020b; Haqbeen et al. 2021b). In addition, a text-based Q&A facility allows participants to type their questions and to upvote questions asked by other participants (Bonifati et al., 2020). Consequently, it can assist participants from various backgrounds to assemble, share experiences, and reciprocally enhance their knowledge and skills.

Session Theme	Paper No.	Paper Type	Session ID	No. of Participation; Posts; Characters (ZOOM)	Mean on Zoom (Posts)	No. of Participation; Likes; Posts; Characters (D-Agree)	Mean on D-Agree (Posts)	Gender
Creative Research Environment	10	Full	S1-1	22; 2; 354	0.09	5; 4; 8; 1552	1.62	Male
	18	Full	S1-2	23; 2; 320	0.08	8; 6; 13; 2638	1.62	Female
	16	Full	S1-3	27; 4; 879	0.14	11; 8; 38; 6486	3.45	Male
	10	Full	S1-4	24; 3; 643	0.12	8; 5; 13; 2413	1.62	Female
Online Discussion and Collaboration	11	Short	S2-1	22; 4; 698	0.18	5; 4; 17; 3310	3.4	Female
	28	Short	S2-2	17; 2; 380	0.11	4; 4; 4; 698	1	Male
	29	Full	S2-3	14; 2; 420	0.14	3; 3; 4; 810	1.33	Male
	3	Full	S2-4	19; 4; 543	0.21	6; 6; 17; 4349	2.83	Female
	6	Full	S2-5	19; 4; 597	0.21	6; 5; 17; 6533	2.83	Female
Machine Learning and Creativity	13	Short	S3-1	21; 2; 732	0.09	6; 4; 9; 967	1.5	Male
	14	Short	S3-2	20; 2; 796	0	5; 4; 5; 1409	1	Male
	12	Short	S3-3	23; 2; 540	0.08	4; 4; 9; 1357	2.25	Male
	15	Short	S3-4	22; 5; 895	0.22	5; 4; 5; 613	1	Male
	23	Full	S3-5	19; 7; 1494	0.36	4; 3; 2; 394	0.5	Male
	22	Full	S3-6	17; 6; 1350	0.35	5; 4; 6; 1091	1.2	Male
Idea Evaluation and Innovation	21	Full	S4-1	19; 2; 350	0.10	4; 0; 6; 1051	1.5	Male
	20	Short	S4-2	13; 2; 256	0.15	4; 3; 9; 2901	2.25	Male
	1	Full	S4-3	25; 2; 345	0.08	6; 5; 18; 3944	3	Male
	7	Full	S4-4	17; 2; 367	0.11	4; 3; 3; 1185	0.75	Male
	17	Full	S4-5	15; 2; 247	0.13	4; 4; 2; 466	0.5	Male
Education and Support	27	Short	S5-1	17; 4; 654	0.23	4; 2; 8; 1597	2	Male
	19	Short	S5-2	15; 0; 0	0	2; 0; 2; 511	1	Male
	25	Short	S5-3	18; 2; 245	0.11	4; 3; 4; 746	1	Male
	5	Short	S5-4	19; 2; 245	0.10	4; 4; 2; 476	0.5	Male
	9	Short	S5-5	26; 2; 432	0.07	6; 4; 13; 1701	2.16	Female
	24	Full	S5-6	23; 4; 640	0.17	3; 2; 4; 875	1.33	Female
	8	Full	S5-7	24; 2; 342	0.08	3; 2; 3; 687	1	Male

Table 1. Characteristic of participation and their submitted opinions (Mean) in Zoom and D-Agree during Q&A session on KICSS2020

5.2 Instruments' limitation and challenges

Despite the advantages offered by Zoom, including its convenience and interactivity during presentations, using it to host virtual venues for scientific events came with some challenges, particularly its inability to read non-verbal cues as a result of inconsistent and delayed connectivity during Q&A session. Indeed, Zoom does not currently have the ability to recover non-verbal messages when one returns to the platform after losing a connection/network (Weller, 2015). In addition, the participants did not ask questions on Zoom chat, perhaps because they did not want to be distracted during their presentations, so as to keep the listeners focused on the presentations. Instead, they continued their questions and discussion on D-Agree. The D-Agree was a welcome technological addition, which both speakers and listeners used to post their questions and answers. In addition, speakers also used the D-Agree to post their slides before their talk. In the future, it is anticipated that the operators of the Zoom platform will improve upon current services by offering enhanced performance and functionality as well as an expanded suite of features. Compared to D-Agree, Zoom has higher potential to attract better communication. Zoom also possesses a number of benefits that enhance its research utility potential. These benefits range from its security features, including user-specific authentication, real-time encryption of meetings, to the ability to backup recordings to online remote server networks ("the cloud") or local drives, which can then be shared securely for the purpose of collaboration. However, unlike D-Agree, Zoom does not have the ability to support non-verbal discussion. Therefore, discourse-centric collective intelligence cannot be maintained, using Zoom. This feature is particularly

important in both synchronous and asynchronous discussions wheretext-based Q&A sessionsareexpectedto stimulate collaboration, as one would envisageatscientific events.

Note that Zoom is not comparable with D-agree at all, as Zoom is a video-conferencing tool and D-Agree is an online text-only discussion support platform. However, based onthe literature and our personal experiencesat participating invirtual conferences, several tools have been used together or as blended solutions to support conferences, as discussed in Section 2.2. To reiterate, this study aimed to study how a blended approach, which involves a mixtureof text-based discussion platform and video-conferencing applicationcould promote participants' engagement in virtual venues, and subsequently, assess the performance metrics of participation (number of times that participants' logs in and the frequency of engaging in discussions) within Q&A sessions, using both tools.

5.3 Research limitations

This is perhaps the first study that examined the differences between a video conferencing tool and a text-based discussion platform in terms of their participation and discussion metrics within in an international conference. However, we also identified some limitations that should be addressed in future works. First, as mentioned previously,the COVID-19 Pandemic adversely affected the number of papers submitted to the conference, which automatically also reduced the representation of correspondent authors and presenters. This in turn affected the sample for this study (n =27), unlike in a typical conference where several hundredsof persons usually participate. We expect that future works should address this challenge by considering online conferences with larger sizes. Also, in this study, we only considered two tools amid limited sample size which comprises participants in similar professional research (scientific) communities.This also should be addressed by adopting various text and video-based applications in a more controlled setting,using a more diverse and differentiated experimentation social blocks and participants/subjects. The reason is that a small sample size, which comprises participants/respondents/subjects with similar backgrounds may affect the online interactions and behaviours of members in a manner that impair generalisability from the sample, unlike larger and more differentiated sample sizes. These contextual conditions should be more elaborated and taken into account in future research.

5.4 Future perspectives

Avenues also exist for further analysis on this experiment. Our results indicate that both Zoom and D-Agree could be either be used for active (i.e., Factor I) or passive (i.e., Factor II) online engagements.We analysed active and passive behaviour on both tools, using analysed data on frequencies of discussions (the number of times participants/authors logged in and posted on both platforms). Our next steps will be to analyse the correlation coefficient of the number of participants who logged into Zoom and those who browsed D-Agree to find out whether the engagement received byvideo-conferencing application had any effect on the attention receivedtext-based discussion tool and whether there is any complementary relationship between the attention received by (or engagement in) video-based and text-based discussions. Furthermore, we will then conduct a principalcomponent analysis, using indicators of the participants' behaviours on Zoom and D-Agree throughout the sessions. We will assume two factors.Factor I might be depicted as the active use of Zoom and D-Agree in terms of the number of participants who logged in and posted questions or comments during the Q&A sessions as well as the number of words in the posts. On the other hand, Factor II will represent a relatively passive use of Zoom in terms of the number of participants who logged in, but did notparticipate in the Q&A sessions, while the number of views or "likes"would be used for D-Agree.

6 CONCLUSION

The present study investigated the participation rates of participantsand their responses (posts) in a real-world experiment on virtual conference, using a video-conferencing tool and text-based discussion support platform. The finding revealed that participation in an online text-based discussion environment is more likely to enhance participants' engagement (in terms of the frequency of exchanging opinions) during Q&A sessions than a video-based communication tool.The study also demonstrates that the number of posted characterswas higher during the Q&A session, using text-based environment. Thus, text-based discussion support environments are more likely to lead to greater participants' engagement. The main results were as

follows: (1) participation in online conferences was associated with both video and text-based discussion environments. (2) Participants who had a desire to express opinions were more likely to join text-based discussion spaces than video-based discussion rooms. (3) The rate of active participants who joined and expressed opinions in the text-based discussion environment was higher than those of participants who joined and expressed opinions in the video-based discussion environment and those who did not express opinions in both environments. (4) The number of passive participants (participation without discussion) was higher in Zoom, while the number of active participants (participation with discussion) was higher in D-Agree. Hence, a text-based discussion environment may better enhance participants' engagement with discussion during Q&A sessions in a virtual conference. In addition, the number of participants who posted opinions via a text-based discussion environment was significantly higher than the number of participants who expressed their opinions/ideas in the video-based discussion environment. The findings of integrating both environments could provide a user-friendly hybrid discussion environment to support virtual conferences. This could offer better opportunities for networking and collaboration among virtual conference attendees.

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