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Source	<i>Proceedings of the 26th International Conference on Computers in Education</i> (pp. 706-714).
Organised by	Asia-Pacific Society for Computers in Education

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A Collaborative Video Annotation and Analytics Environment (CoVAA) Intervention: User Experiences and Reflections of Teacher-Practitioners

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Abstract: This paper foregrounds teacher practitioners' implementation experiences and reflections of a web-based Collaborative Video Annotation and Learning Analytics (CoVAA) intervention aimed at enhancing video-based teaching and learning in schools, with a view to foster secondary students' conceptual understanding, social knowledge construction, and self-regulated learning dispositions. We first briefly outline the key learning principles that underpin the design of CoVAA, namely social dialogic learning, assessment for learning, and computer-supported collaborative learning. Next, we explain its two key learning affordances: (i) timepoint-based collaborative video annotation supplemented by a live interactive chatboard, and (ii) rapid digital formative feedback in the form of teacher and learner dashboards. We then illustrate how teachers implement these in their classrooms. Teachers' sense-making of the learning and teaching gains, challenges and pathways forward for leveraging on these contemporary digital social learning affordances to enhance video-based classroom practices are presented and discussed.

Keywords: Video-based Learning, Learning Analytics, Learner Dashboards, Teacher Dashboards, Computer-Supported Collaborative Learning, Dialogic Learning, Assessment for Learning

1. Introduction

Video-based learning and flipped classroom pedagogy are being increasingly appropriated in K-12 schools and classrooms worldwide. Some of the common reasons for this growing trend include: (i) moving content coverage outside of class time, thereby freeing-up class time for collaborative knowledge construction through purposefully-designed social learning interactions with peers and teachers; (ii) enabling individualized and differentiated learning; (iii) shifting pedagogy from a largely transmissionist approach to more learner-centric inquiry; as well as (iv) allowing parental/guardian involvement in student learning (Abeysekera & Dawson, 2014; Bergmann & Sams, 2012; Tan & Koh, 2017). However, in practice, teachers often encounter a number of key implementation challenges. First, the quality and effectiveness of video-based learning and flipped classroom pedagogical enactments can vary significantly, resulting in uneven and inconclusive empirical evidence about the extent to which the 'promises' of deeper and richer student learning outcomes are in fact achieved. This issue is in turn exacerbated by the lack of meaningful and timely learning process data to monitor and inform students' engagement, understanding and learning with the video learning resources used in such flipped classroom pedagogical enactments. These aspects are also common in Singapore and serve as the impetus for our Collaborative Video Annotation and Analytics (CoVAA) learning intervention.

2. CoVAA: Design principles, learning affordances and implementation

CoVAA is a web-based collaborative video annotation and learning analytics environment that was developed as part of a design-based research project funded by Singapore’s National Research Foundation eduLab Programme. Launched in 2016, CoVAA has undergone two field trials at the time of writing, involving 2 schools, 3 subjects (Social Studies, Geography and Science), 7 teachers, 12 classes, and 346 students in Singapore.

In brief, CoVAA blends time point-based video annotation and interactive comments features, with dynamic learning analytics modules that enable teachers to (i) choose/upload video learning resources, (ii) embed purposefully designed pedagogical scaffolds and prompting questions, and (iii) continuously monitor learning progress and adapt pedagogical strategies to stimulate students’ deep socio-cognitive engagement, rich peer interactions and social knowledge construction around key disciplinary concepts of interest—before, during and beyond formal class time. These features were adapted and augmented from a web-based, open-source educational software known as the Collaborative Lecture Annotation System (CLAS) that had been developed and trialled, refined and adopted across multiple disciplines in various higher learning institutions since 2012 (Risko, Foulsham, Dawson, & Kingstone, 2013).

2.1 Techno-pedagogical design principles underpinning CoVAA

The techno-pedagogical design of CoVAA is informed by three key learning and pedagogical frames: (1) dialogic teaching and learning (Alexander, 2008), reinforced by (2) an Assessment for Learning (AfL) framework (Black & Wiliam, 1998), and situated within (3) a computer-supported collaborative learning (CSCL) paradigm premised on social knowledge construction pedagogical approaches (Jonassen, 1995; Pena-Shaff & Nicholls, 2004; Stahl, Koschmann, & Suthers, 2006; Vygotsky, 1978). These principles (further elaborated in Figure 1) constitute long-established progressive learning theories that have a significant corpus of empirical evidence substantiating their effectiveness in promoting deeper learning outcomes for students. Furthermore, more recent research in the field of computer-supported collaborative learning (CSCL) and learning analytics (LA) have also provided empirical evidence on the impact of using video annotation and pertinent learning analytics data in promoting better academic performance, self-regulated learning and motivation in flipped learning environments (Risko et al., 2013; Mirriahi, Liaqat, Dawson, & Gašević, 2016).

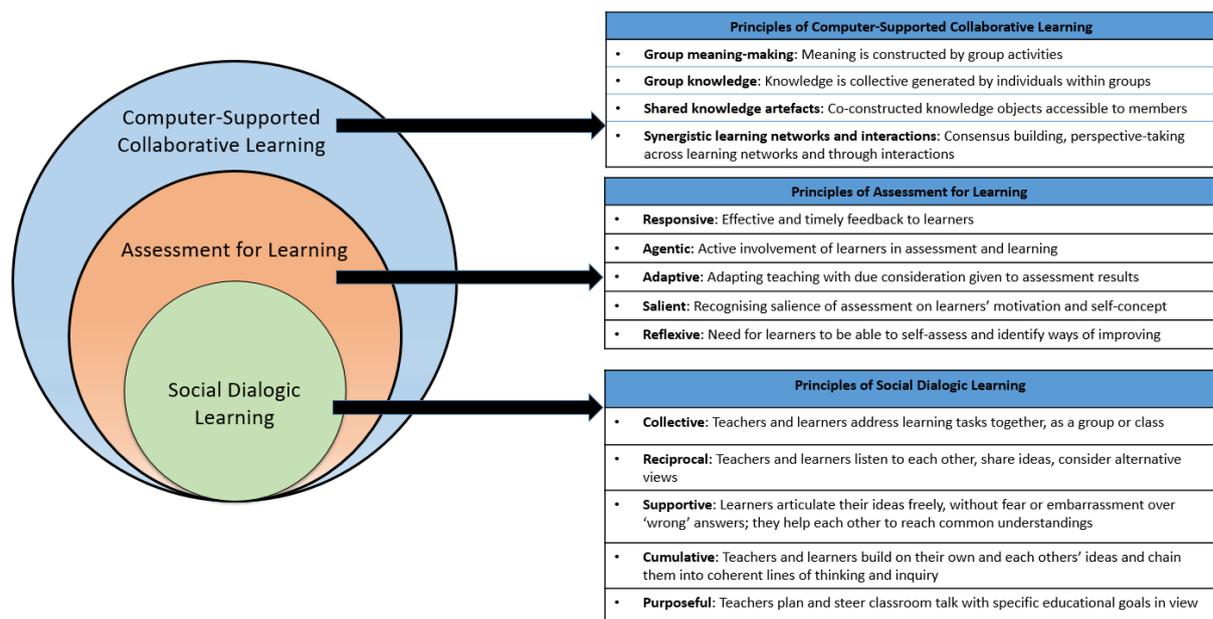


Figure 1. Learning and pedagogical principles underpinning CoVAA

2.2 CoVAA Learning Affordances and Use in Social Studies, Geography and Science

These design principles buttress the two key affordances in COVAA, namely, (1) timepoint-based collaborative video annotation with a live interactive chatboard, and (2) rapid digital formative feedback in the form of a teaching and learning dashboard. The following sections describe the affordances and how they were used by the teachers in Social Studies, Geography, and Science over the two trials.

2.2.1 Learning affordance 1: Timepoint-based collaborative video annotation and interactive 'live' chat

The timepoint-based collaborative video annotation and interactive 'live' chat are critical features in guiding dialogic learning among students. The timepoint-based collaborative video annotation enables teachers to post/embed video resources explicating key concepts in the topic of interest for student viewing, annotation, learning, and discussion on one single platform. Teachers and students can make annotations throughout the length of the video, and students can share annotations, review peer annotations, and view/receive teacher feedback within the collaborative learning space. This timepoint-based collaborative video annotation feature is complemented by an in-built synchronous chatboard or discussion comments panel (Figure 2). Teachers are able to embed purposefully designed pedagogical scaffolds/prompting questions to engage in students' richer dialogue and social knowledge construction around their understandings of key concepts being covered. The chatboard feature in CoVAA further allows teachers to be actively involved in productive learning conversations after class by posting additional questions and learning resources in support of developing students' overall conceptual understanding of topics concerned.

In Geography and Science, teachers targeted content-heavy curriculum topics that can be tedious to cover using direct instruction methods. These included "Causes and Impacts of Climate Change" (Secondary 3, Elective Geography), "Tropical Cyclones" (Secondary 3, Core Geography), and "Transpiration" (Secondary 1, Combined Science). Teachers uploaded video lesson materials on these topics and embedded specific scaffolding annotation questions at critical timepoints, to guide students' engagement with critical concepts. Teachers further posted higher-order questions in the 'live' chatboard to extend students' overall comprehension, synthesis and application. Students' responses and discussions would then provide a measure of their depth of understanding of the key threshold concepts. In Social Studies, teachers also uploaded and used a variety of videos, but with the emphasis on leveraging the 'live' interactive chat feature for students to build on one another's knowledge and develop perspective-taking around controversial social issues. Topics covered included "What are the experiences and effects of living in a diverse society?" and "How can we respond in a diverse society?"

In all subjects, students had to choose one *critical lens* and *thinking skill* (see Figure 2) to tag their annotations and comments. The design of these *critical lens* and *thinking skills* were informed by Paul and Elder's (2001) "wheel of critical reasoning" and our own work on dialogic indicators of collective creativity and criticality (Tan, Caleon, Jonathan, & Koh, 2014). These tags served as micro-pedagogical scaffolds, stimulating students' metacognition to actively and critically frame their thinking and discussion. In this way, students develop their perspective-taking and meaning-making capabilities as they make annotations and comments. Moreover, collaborative learning will also be fostered as students review their peers' annotations and other blended modes of learning (e.g. with internet search engines and conventional modes of learning such as textbooks, notebooks, and paper references) to verify their understanding of the concepts taught.

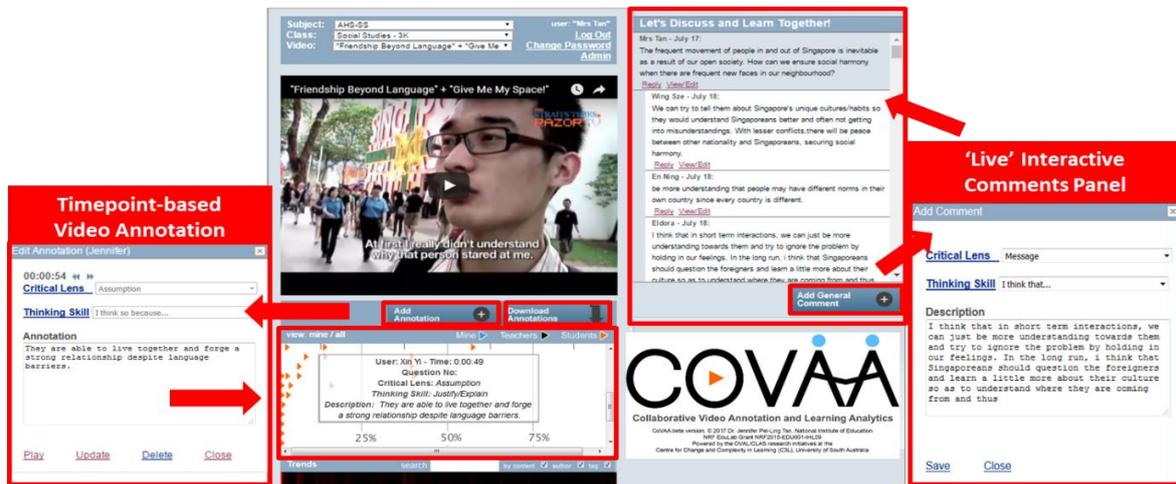


Figure 2. Collaborative timepoint-based video annotation and interactive chatboard

Teachers were able to view students' annotations on-screen during class, download and review students' annotations after class, to showcase examples of exemplary comments and/or address misconceptions at a class-wide level during consolidation (see Figure 3). Teachers often took a blended teaching approach by combining CoVAA with other modes of teaching, such as smartboards, whiteboards, and PowerPoint slides, among others (Figure 4).

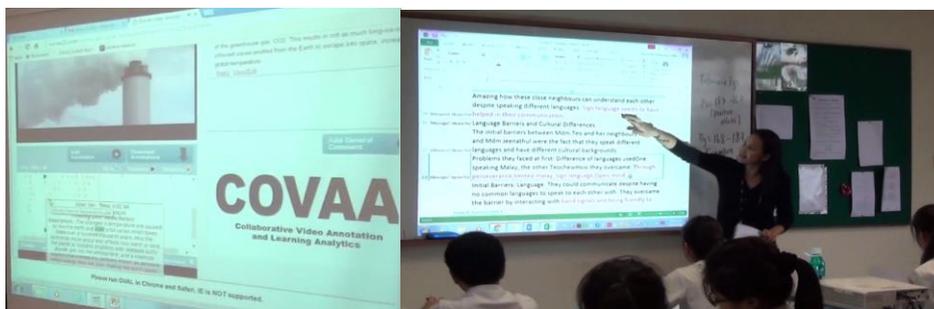


Figure 3. Teacher addressing misconceptions using on-screen annotations and downloaded annotations in class



Figure 4. Teachers combining CoVAA with other teaching modalities/tools in class

2.2.2 Learning Affordance 2: Teaching and learning dashboard

The teaching and learning dashboard is a learning analytics component of CoVAA. It supports assessment for learning principles by according teachers with the tools for providing formative feedback and mediating discussions at critical junctures to stimulate deeper and more critical reading engagement from students. As shown in figure 5, the teacher dashboard is designed to facilitate timely and meaningful formative feedback by displaying comprehensive data of student-student and student-teacher learning networks and behaviours on tasks. This enables

educators to monitor and guide their students' learning such as through prompting participation from disengaged students and encouraging them to deepen the quality of their annotations and comments. The benefits of these learning analytics are, however, not limited solely to teachers. The visualizations of learning networks also allows students to self-monitor and adapt their learning behaviour. In so doing, it cultivates self-regulated learning as a key facet of the learning process. This development is a work-in-progress for an upcoming trial.

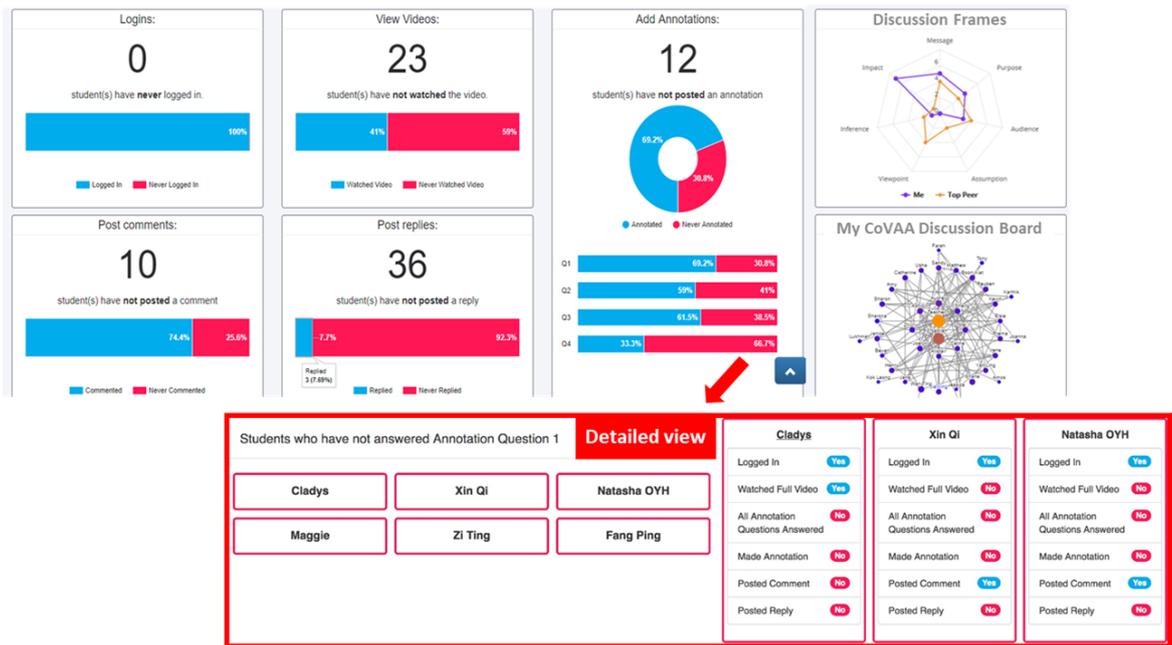


Figure 5. Teaching and learning dashboard

3. Methodology

The study employed a mixed-methods design-based research approach, involving the collection of both quantitative and qualitative data pre- and post-intervention trials. CoVAA was implemented over two trials, involving 7 teachers and approximately 346 students across 12 classes. Each topic was covered in approximately 3-5 lesson periods, using a blended learning approach. Typically, in the first lesson, students were introduced to CoVAA. In subsequent sessions, students spent at least 1 lesson using CoVAA in the computer labs, complemented often by e-learning on CoVAA at home, although this was not mandatory. The final lesson in-class would be a consolidation of the key points learnt during the trial, often with the use of CoVAA by the teacher as part of a larger blended classroom pedagogy.

Quantitative data included pre- and post-intervention student self-reported questionnaires and conceptual tests. Qualitative data was collected through (i) open-ended feedback forms asking students about their experience using CoVAA, (ii) focus group discussions (FGDs) with students after each trial, (iii) teacher interviews and/or FGDs after each trial, and (iv) lesson observations. While discussions in student FGDs centered on the effectiveness of key features of CoVAA in enhancing students' learning behaviour, teacher interviews sought to uncover a practitioners' perspective in monitoring formative assessment and some of the challenges in conducting lessons on CoVAA.

For this paper, we focused on the teachers' experiences of using CoVAA to enrich video-based learning and teaching in their classes. As such, this paper focuses on the qualitative data generated from teacher interviews and FGDs, as well as lesson observations, in order to highlight the benefits and challenges observed by the teachers from the two trials. Thematic content analysis, in which the research data was iteratively analyzed, grouped and distilled to "generate a list of common themes in order to give expression to the communality of voices across participants" was undertaken, with every reasonable attempt "made to employ names for themes from the actual words of

participants and to group themes in manner that directly reflects the texts as a whole” (Anderson, 2007, p.1; Vaismoradi, Turunen, & Bondas, 2013).

4. Teacher reflections: Benefits and challenges

The thematic analysis of the data gave rise to the following observations pertaining to the benefits and challenges of CoVAA.

4.1 Benefits of CoVAA

4.1.1 Learning at one’s own pace

Teachers observed that video-based learning supported by the timepoint-based video annotations fostered individualized learning by allowing students to pause, re-watch a video, and answer the questions at their own pace. As one teacher remarked, “[*the students*] can do a lot of independent learning on their own, very much left on their own. And they can go back and forth [in] the video, as and when they like. There’s no stress, you know, that you have to follow the pace of the teacher.” (Teacher 5, Geography Trial 1 Interview). Some educators found the timepoint-based video annotations useful for slower learners as it allows them to learn at their own pace, thereby raising their attentiveness and self-confidence in the content, “*I find that learning at your own pace and “as you please” boosts the student as they feel comfortable while doing work. So they would be more attentive to the lesson rather than feeling uncomfortable, or struggling with fast lessons.*” (1E423, Science, T1 Survey).

4.1.2 Encouraging peer learning

Teachers shared that CoVAA allows students to tap on their peers’ expertise and external sources of knowledge. Through discussions on the live chatboard and checking for information in the World Wide Web, students were able to ideate freely with their peers, thereby expanding their exposure to multiple viewpoints. More importantly, all students were engaged, including the quieter ones, “*I like CoVAA because yes you get to hear the quiet ones and then the students themselves can get to see each other’s answers compared to Google and they say... “oh, he or she has a same perspective”, “oh, why didn’t I think of that”. That [is the] kind of different perspectives you can get as you read different classmates’ answers.*” (Teacher 7, Social Studies, Trial 2, Teacher FGD).

In reviewing their peers’ annotations in real time, it also provided an opportunity for students to clarify their misinterpretations over specific ideas and improve their own answers. Some teachers noted, “*I thought it will be good to get them [the class] to look at their friends’ annotations. Because I think some of them went back to change the answers, and to add on to their answers... They must be reading something and they find that the answers are lacking, and then they went back to refine their answers. Which is good... they are learning on their own.*” (Teacher 4, Geography, Trial 1, Teacher Interview).

4.1.3 Fostering deeper learning

CoVAA’s design also aided in activating the meta-cognition of its users and improved their engagement with big ideas. The annotations guided students by highlighting key concepts throughout the video which deepens their analysis of concepts taught. As one educator remarked, “*for [one class], they even went a bit further. They went to look at the video... they think of the questions and then they even came out with [their own questions]. They even [did] their own research, and ... included some of the links, the examples of, from some news articles that they found online.*” (Teacher 1, Social Studies, Trial 1, Teacher Interview).

As CoVAA allowed learning to take place at home as well as in school, this created more time and space for richer discussion and deeper learning. A teacher elaborated, “[*Using CoVAA for Social Studies*] at home as a flipped classroom... they [students] have more time to think ... [and

more opportunity] to discuss it with [their] family members... that's a good thing because they start talking about these societal issues at home as well." (Teacher 1, Social Studies, Trial 2, Teacher FGD). This suggests that students were able to gain more nuanced understandings of the topic through discussions with a wider group of stakeholders, not only their peers.

4.1.4 Efficient monitoring by teachers

Many teachers remarked that CoVAA is useful for formative assessment in that it becomes easier to oversee students' participation in 'real-time', which is not possible in a normal classroom setting. Through the teaching dashboard, CoVAA assisted educators to better monitor student learning by allowing for efficient viewing of all students' annotations and discussion comments in real-time. This, in turn, allowed teachers to provide personalized feedback and timely responses and clarify misconceptions efficiently. As one educator remarked, "*[CoVAA] is a form of formative assessment as well. I can see where they [students] are going ... [students can] see... where they are at this moment, and... how to link this back to the whole issue, which is on Issue 2, on 'Living in a diverse society'.*" (Teacher 1, Social Studies, Trial 1 Teacher Interview).

4.2 Challenges and limitations

4.2.1 Pressures of time and content coverage in current schooling culture

A major challenge in using CoVAA in class was the time constraint required to enact and realize fully the pedagogical affordances of CoVAA within the curriculum content structure. Students demonstrated high levels of engagement when collaboratively annotating on the videos in response to teachers' scaffolding questions, sometimes to a much longer extent than what was budgeted for by the teacher. "*[Students] can go back and forth many times... The minus point will be; it takes a long time. So you really cannot be too ambitious, to cover too much. The problem is you have to finish the syllabus.*" (Teacher 5, Geography, T1 Teacher Interview). Despite this, teachers were observed to be highly adaptive and flexible in the curriculum enactment during the trials, especially in overcoming the structural time constraint barrier.

4.2.2 Students' mindset toward online learning

Several teachers have noted that prevailing attitudes amongst their students toward learning might limit CoVAA's objective of inculcating self-regulated and independent learners. Rather than proactive engagement, for instance, some students possessed a 'completion mindset' towards CoVAA where annotated tasks were completed for the sake of it. Furthermore, teachers highlighted that students may have a traditional view that classroom learning is 'more important' than online learning, perceiving a teacher's role as merely to provide the 'correct answers'. One teacher shared that after a CoVAA lesson, she found that her students "*still had this idea of not feeling very secure... they [asked], 'Teacher, that's it ah?' I said, 'Yes, basically that's what the content is about. I mean, it's not only just from the video, when you go home, even if I'm teaching you, you also will have to look through the textbook, to read again.'*" *But they were just very insecure.*" The teacher continued to elaborate that students did not feel "*safe*" as the teacher did "*not teach*", rather, they "*watched the video*" to understand "*the content.*" (Teacher 4, Geography, Trial 1, Teacher FGD). This suggests that students' mindset of learning, where knowledge may not come from the teacher, is an area to be addressed in future CoVAA interventions.

4.2.3 Technological and logistical issues: Copyright issues and quality of video resources

In searching for educational videos, teachers often faced difficulties securing a video that balanced explaining complex concepts with sufficient room for questioning. Whereas videos that deal with elucidating fundamental concepts can be understood by a vast majority of students, it may be less effective in cultivating independent and collaborative learning compared to videos that cover contentious issues that require deeper analysis and critical thought. A teacher highlighted, "*it is not*

easy to find very good videos that can cover all the things that we want to say. So, perhaps, even in a particular area that I want to teach, then this video is only for this section, this video is for this section. So there will be a lot of videos.” (Teacher 4, Geography, Trial 1, Teacher FGD).

Even upon finding the appropriate video, teachers also encountered obstacles owing to copyright and licensing. Additionally, ensuring that all students participate in CoVAA during class time requires one-to-one computer and Internet access. This requires coordination between the IT department and the respective subject departments. Some teachers mentioned that the logistics of moving from classrooms to computer labs could detract students from learning time.

5. Concluding Remarks

The CoVAA intervention with its techno-pedagogical design and affordances, was seen from the teachers’ lenses as being effective in creating a collaborative and more inclusive learning environment for students, and encouraging them to become more independent learners. It also optimizes learning time in class and at home and supports educators in monitoring student progress. While this suggests that CoVAA has the capacity to enhance students’ conceptual understanding and self-regulated learning and provide for social knowledge construction, the perennial challenges of time constraints, and technological and logistical issues remained. Interestingly, we realized that students’ learning mindset is an important aspect to address in this digital age. Could students in Secondary Schools already be inculcated to learn in a certain frame? How can we encourage shifts in learning mindsets to more connected and open ones?

Despite the associated challenges, we believe that the learning affordances of CoVAA are steps towards addressing such shifts in learning mindsets and designs. Moving forward, we are seeking to generate micro-case studies of teachers’ pedagogical adaptations to address diverse learner needs. This involves evaluating the efficacy of diverse pedagogical models and identifying enablers and anticipating challenges to its wider adoption. To this end, we plan to conduct more Teacher Professional development sharing workshops and sessions. As a further follow-up to our analysis, we hope to examine if there are distinctions amongst teachers who teach different subjects. Through continued research-practice partnerships, we hope to encourage more optimal video-based learning practices in K-12, which in turn will develop deeper and more self-regulated learning amongst our students.

Acknowledgements

This paper refers to data and analysis from the research project NRF2015-EDU001-IHL09 (ethics approval reference number: IRB-2016-07-008) funded by the Singapore National Research Foundation, eduLab Research Program. The views expressed in this paper are the authors’ and do not necessarily represent the views of the National Institute of Education. The authors also thank Joanna Ong and Christin Jonathan for their contributions as research assistants in this project.

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