TechTrends
https://doi.org/10.1007/s11528-018-0336-z

ORIGINAL PAPER

Increasing Interaction in a Flipped Online Classroom through Video Conferencing

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Abstract
Interactive learning is vital to schooled learning because it encourages and enables the exploration and application of knowledge. The difficulty of providing for this learning-based interaction among students who never meet in person has been a continuing concern in online education. This paper describes six different interactive structures (whole group discussions, break-out groups, show-and-tell, independent small groups, online conferences, and virtual poster sessions) developed to allow students in online courses to interact virtually face-to-face using free video conferencing programs and discusses the advantages and disadvantages of each. Student response to these video conferencing structures in 18 fully online classes was overwhelmingly positive, based on data from anonymous end-of-course evaluations. Student comments emphasized increased engagement and enjoyment from being able to see and talk with each other in both large and small groups, and the value of the relationships and learning community they believed such interaction fostered.

Keywords Distance education · Flipped classes · Interactive learning · Online learning · Post-secondary education · Video conferencing

Currently prominent constructivist theories of learning (e.g., Piaget 1970; Rogoff 1990; Vygotsky 1978) hold that people learn best through social interaction around authentic activities and questions, because it is through exploration and application of knowledge that people learn most and best retain that knowledge. Though traditional lecture-based instruction remains a dominant mode of teaching in higher education (Chaudhury 2011; Lambert 2012), those concerned with higher education pedagogy have long sought alternatives that would better foster this sort of interactive learning (National Institute of Education 1984).

An increasingly popular strategy in higher education (Abeysekera and Dawson 2015; Berrett 2012; Knapp et al. 2013), is commonly known as "flipping" a course. A flipped course reverses the traditional course design, so that "instruction that used to occur in class [e.g., demonstration or lecture] is now accessed at home, in advance of class. Class becomes the place to work through problems, advance concepts, and engage in collaborative learning" (Tucker 2012, p. 82; see also Bergman and Sams 2012). In face-to-face flipped college classes, students access videotaped lectures and demonstrations and multiple types of texts through a Learning Management System (LMS) before attending class. Online classes have been using LMS's in this way for many years, but, ironically, they often lack the other half of the equation: effective interactive spaces for students to do real-time, collaborative discussion and learning.

Lack of such interactivity has been a serious concern since the early days of online learning, when MBA students studied by Kim et al. (2005) cited "difficulty in communicating with peers [due in part to] the absence of face-to-face contacts" as their greatest challenge in online learning (p. 342) (see also McInnerney and Roberts 2004; Muilenburg and Berge 2005). It remains a significant issue to this day. Keengwe et al. (2013) lament that, "due to the absence of face-to-face contacts, students and instructors are usually faced with the lack of active social presence and meaningful interactions in online learning" (p. 597). The six "exemplary online teachers" studied by Baran et al. (2013) acknowledged that even they "were not that successful in terms of building relationships with students because of the absence of immediacy and sensory and expressive information, [and] nonverbal cues" (p. 26). The

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Published online: 05 October 2018

high rate of student attrition in online courses is still "a critical issue" in higher education (Allen and Seaman 2015, p. 25), and a frequently cited cause for this attrition is the sense of isolation and disengagement online students often experience due to the lack of these familiar types of social interaction (Roberts and McInnerney 2007; Yuan and Kim 2014).

Using the LMS provided at my university, I had already begun to experiment with flipping my traditional face-to-face (F2F) courses in 2011. For all the reasons listed above, when I began to teach fully online classes four years ago, I was determined that my online students should be able to experience, as nearly as possible, the full benefits of the flipped classroom. I wanted them to have both the advantages of anytime online access to taped lectures and multiple multimedia resources and of the generative kinds of learning interactions that students in my F2F classes had always experienced: flexible large and small group discussions and problem-solving activities, with and without teacher mediation, occurring in real-time (without artificial turn-taking constraints), orally (without the constraints of typing and reading), and with the added communicative cues of vocal and facial expressions. In this paper I will describe and discuss the advantages and disadvantages of six interaction structures I have developed using free video-conferencing programs that allow my online students to communicate "virtually face-to-face." I will then summarize student responses to the use of these structures in online courses over the past four years based on data from anonymous end-of-course evaluations.

Choosing a Video Conferencing Program to Maximize Interaction

In designing my first online classes, I wanted a program that would allow students to talk freely and naturally, to laugh and comment and engage in overlapping talk, just as they would in a F2F classroom. I wanted them to be able to see all the other students throughout the discussion, rather than just one or a handful of students at a time, to both increase the sense of social presence and include those nonverbal cues that are such an important part of communication. The program needed to facilitate the onscreen sharing of visuals and documents quickly and easily. It also needed to be relatively easy to access and use, so that I could focus on teaching, rather than technology management, during online meetings, and so that students could set up and host their own small group conferences with only ordinary technology equipment and skills. Finally, since I had no budget, I needed a program that was free for both me and the students.

These requirements eliminated the video conferencing tools available within our university-sponsored LMS; therefore, I started by using *Google Hangouts*, which offers all these features, along with two others: a side chat bar where students can post links and engage in side conversations, and the ability to record sessions for later viewing. *Hangouts'* main disadvantage is that the free version will hold up to only ten participants, so for larger class meetings I have since switched to using *Big Blue Button* through the free *Canvas* LMS, which offers all the same features, and is only a bit more complicated to use than *Hangouts.* There are probably a number of other programs out there that will do the same things, but these two have worked well for me.

The Flipped Online Course Design

The flipped courses described in this paper meet both of the criteria laid out in the literature reviewed above: open access to multiple multimedia resources, including videotaped lectures, and effective interactive spaces for students to do real-time, collaborative discussion and learning. These courses are primarily designed for Masters' students in our fully online School Library Media, Instructional Technology, and Instructional Development and Design programs. Though students in these programs may live anywhere in the country or the world, most live here in Georgia and are working professionals, so synchronous whole class meetings are typically held in the evenings. Although the courses covered different topics, I structured them all using the same general instructional design, based around the six interaction structures discussed below and weekly or biweekly modules (posted in our university's LMS) which organize all the resources and activities students will read, watch, access, or do prior to the next synchronous online meeting.

Each module has two basic components: an instruction sheet (see Fig. 1 for an example) which organizes all the learning resources (e.g., readings, videos, websites–complete with outside links as needed) and a "lecture," a 10–30 min screencast during which I go over some main points related to the topic of the module and introduce the resources. Each module also contains a small-group or individual reflective assignment for students to complete in preparation for our next online class meeting, plus a number of optional resources for students who want to dig more deeply into a particular topic. Results of the small group or individual assignments are either shared in varying formats during our online meeting or posted to a more traditional discussion board in the LMS. In the latter case, I often compile a summary of quotes from student postings to share and serve as a discussion starter for whole or small group conversations during the meetings. In this way, none of our synchronous online time is spent on lectures or group watching of videos, etc., which is all done before we meet, so that during our time together we can share ideas, ask questions, and discuss issues using one or more of the following six basic interaction structures.

Week 7 – Phonics, Vocabulary, and Early Reading

WATCH these two videos of "emergent readers"

Colin (https://www.youtube.com/watch?v=f4jSEKnlo0E)

Zephan (https://www.youtube.com/watch?v=b-aE9Ev34sM)

WATCH the Screencast for Week 7 (http://www.youtube.com/watch?v=HYWyYUHPBs8)

READ: Stahl (1992) *Saying the "P" Word*

READ ONE of these (or both, of course, if you want to):

Blachowitz & Obrochta (2005) *Vocabulary Visits* (best for preK-2)

Ruddell &Shearer (2002) *Vocabulary Self-Collection Strategy* (best for grades 3 & up)

POST to ONE (or both, if you wish) of the Discussion threads in the "Early Reading" forum by noon on Tuesday, **Feb. 18**, and be prepared to share your thinking in our online class meeting that evening. One question asks about your thinking about Phonics teaching today, while the other asks about resources you have found particularly useful in encouraging phonemic awareness and phonics knowledge in kids.

Because there are two distinct questions for this reflection, please just reply under the threads, rather than starting new ones (although, as always, feel free to start your own threads for additional questions/issues about early reading as well).

OPTIONAL: There is a bunch of great optional stuff this week--read whatever you want/have time for &/or maybe save some to share with teachers or administrators . . .

If you want to know more about emergent readers, read Elizabeth Sulzby's classic article: Sulzby (1985) *Children's Emergent Reading of Favorite Storybooks*

For a discussion of the value of picture books (esp. in the early years), read Von Drasek (2010) *The Importance of Picture Books.* Use this article to defend your purchase of picture books in the library or to share with teachers who are feeling pressured to move kids quickly to "chapter" books.

Chapman (2003) *Phonemic Awareness* clearly separates our real knowledge from myths that have grown up around this topic. Another great article to share.

Cunningham & Cunningham (1992) *Making Words* describes the hands-down best phonics teaching strategy I have ever seen, useful from first grade through high school. It adapts well to use in the library, and it's fun, too!

Vaughn (2011) *Learning Sight Words by Choice* is a single page summary of a method developed by a second grade teacher I worked with several years ago who achieved brilliant success in helping her low SES, delayed readers learn sight words.

Have fun!

Fig. 1 Example of weekly instructions showing structure of flipped online modules (taken from EDIT 6330E, a class on reading primarily for school librarians)

Six Ways to Structure Online Interaction Via Video Conferencing

Whole Group Discussions

Whole-group discussion is the interactive format I use most commonly, comprising eight or so of the weekly meetings across a 15-week semester. Whole group sessions typically last only 60–90 minutes, and I always have a foundational question or activity planned to start off our discussions, such as excerpts from their reflective comments to share or a thumbs-up-or-down vote on a particularly contentious issue raised in one of the resources. However, just as in a good F2F class, conversation usually takes off and moves well beyond the initial issue into connections students have made, questions they have, and ideas they have developed by connecting what they have viewed and read to their own experiences and concerns. Because we can all see and hear each other and interact spontaneously and informally, these sessions have much the same feel as a good F2F class discussion, which was my goal.

In some ways online video conferencing actually has a number of potential advantages over F2F classes in terms of facilitating student discussion, in part because the instructor's role is somewhat downplayed by the technology. There is no instructor's podium or "front of the room"; mine is just one of multiple faces on the screen. Although the instructor could control the focus, the video conferencing software focuses by default on whoever is talking, and the screen share function allows any class member to quickly throw a picture or a piece of text up on the screen for everyone to view and respond to. Participants can also use the chat bar to post references or

resources or conduct sidebar conversations while the whole group is talking. Of course, video conferencing from varied remote locations somewhat increases the potential for distraction, as compared to F2F classes with everyone gathered in a single classroom. Outside noises can be picked up on microphone, and children and pets often wander into video range and become part of the discussion, but even such distractions can help to increase a sense of community among students who are sometimes literally half a world apart.

If classes contain a larger number of students or students in widely varying time zones, scheduling whole group sessions can be a problem, but this can often be worked out. One of my classes included two students in China, but we were still able to settle on a joint time (7:00 p.m. EST, which was 8:00 a.m. for them in China), and no student commented on evaluations that this was an issue. If a class is larger than 20 or so students (mine typically range from 16 to 25), individual participant pictures on the conferencing screen can get rather small, and quiet students can get overlooked or silenced, a problem that also occurs in F2F whole class discussions. In a size-limited program like *Google Hangouts,* a class of 20 will not even be able to participate in a single conference session. I have sometimes resolved such issues by splitting the class and simply running two class sessions at slightly different times, which takes some additional effort, but is worthwhile due to the stronger interactive learning community fostered and increased adaptability to students' schedules.

Small, Break-Out Groups

By using a second device, with either *Google Hangouts* or *Canvas/Big Blue Button*, I can quickly move students from a whole class session into two smaller discussion groups, to more deeply share experiences, answer questions, or discuss case studies, and then bring them back together to report on their discussions. This is best done by leaving half the group in the main conference and inviting the others to a second video conference. When I separate students into small groups like this, I screen share the discussion questions or other discussion stimulus on my video feed to each group, thus providing an ongoing focus for the group discussion, but also removing my face from the video line up. I can then mute the microphones on both devices and listen in to both small group discussions, dropping back in only if there is a need to do so. This is another advantage I have found in online interactions. In F2F classes it can be a bit awkward during small group work trying to move unobtrusively from group to group to monitor or prompt; the teacher's presence can alter and often diminish student-to-student talk within a group. But with my face and voice absent from the videoconference, students tend to forget I am there, and conversations become much more animated and genuine than many F2F small group discussions I have observed. The only downside to creating small break-out groups this way is the occasional student who gets lost or dropped moving from one conference to another, but this has rarely been more than a temporary glitch; everyone usually finds their way back to the main conference relatively quickly.

Virtual Show-and-Tell

Show-and-tell sessions make the fullest use of the screen sharing/presentation function common to most video conferencing programs. I have used this format for the usual class project presentations, just as one might schedule PowerPoint presentations in a traditional F2F classroom, but the ease of screen sharing in video conferencing allows for shorter, more frequent and much less formal show-and-tell sessions as well. For example, before the first session of my multicultural class (EDIT 6600E: Diversity, Learning and Technology), I usually ask students to put together a truncated *pecha kucha* featuring slides of three objects that represent or symbolize aspects of some cultural group(s) to which they belong. Objects thus shared have ranged from an old drum majorette baton (marching band culture) to a Yoda figurine (Star Wars fan culture) and a family portrait. Each person shows her or his slide presentation for 60 seconds and answers questions from the group for another 120 seconds, and then the next person speaks, which allows the whole class to get to know each other a little better in an hour or less.

This show-and-tell format can be also used in smaller groups to allow students to share more fully products or projects they are working on and get immediate feedback from their peers. Not only does this help them improve their work prior to turning it in for a grade, it seems to increase their engagement in assignments, since I am no longer the only audience. Impromptu show-and-tells can be also used to revitalize a lagging class discussion by giving students three minutes to find an image online that conveys their current question, conviction, or feeling about the topic under discussion. As people screen share their found images, the conversation becomes both livelier and more grounded, and even the quietest students can thus contribute to the discussion.

Independent Small Groups

Students also use video conferencing to meet in small groups independently outside of class to complete regular small group assignments or larger projects. In fact, video conferencing can be so effective and convenient that I now recommend that students in my F2F classes conduct their outside small group meetings using this format. Prior to encouraging this kind of video conferencing, I had noticed, as have many instructors, that independent group projects in my classes often gave evidence of what might be best termed "pseudo-collaboration." Because of difficulties in finding time, transportation, or

energy for extended face-to-face meetings, small group members would often divide up a project into sections, with each person autonomously writing or constructing her or his own part, and then combine their sections into a basically cut-and-paste final product that involved little or no real collaboration, discussion, or sharing and critique of ideas. Through video conferencing, small groups can meet from their homes or work at any mutually convenient time, for short or long sessions or even in sub-groups as needed, which greatly encourages planning, discussion, and revision. Best of all, by coordinating with *Google Drive*, everyone can talk together as they add to and edit documents or other digital products in real time.

Individual Student Conferences

All my classes culminate in students' producing some sort of authentic product. This final product must be related to the class topics, but also of real use to them as scholar or practitioner. Products are chosen and designed by each student and have ranged from action research projects or larger research proposals, through innovative instructional units or business technology applications, to literature reviews for theses or drafts of papers for publication. To mentor students' work in these projects, once or twice a term, instead of a whole class session, I will schedule a week of individual 30-min video conferences. Using screen sharing and *Google Docs* capabilities, a student and I can easily talk online, look at any texts we have questions about, go through written comments on a draft, or even make trial edits on a work in progress; in short, we can do everything that could be done in a regular conference in my office on campus. If anything, these video conferences seem to work a bit better for many students, since they can talk from home or work and do not have to go through the hassles of getting baby sitters and finding a parking place on campus, etc., so this is again a practice I have imported from my online teaching to use with my F2F classes.

The Virtual Poster Session

One of the more unusual video conferencing formats, a virtual poster session mimics the interaction pattern of a poster session at a conference. I use this format to give students the opportunity to briefly present the results of their final projects to a small group of peers and also see the projects of their peers in which they have particular interest. Prior to the poster session, usually scheduled for one of the two final classes, I ask students to identify which of their classmates' projects they most want to see, and I try to schedule them into as many of these as possible. Each presenter presents for five minutes, takes comments or questions for five minutes, and then the groupings switch. Presenters talk and screen share their own presentation resources (whether video or slides or a brief demonstration), but I handle scheduling and timing, inviting students into the next set of pre-scheduled conferences every 10–12 min. Theoretically, an instructor could run as many simultaneous poster groups as there were devices available, but I have found that running two groups at once, with five to seven consecutive sessions in an evening, is a practical limit. Students have greatly enjoyed these virtual poster sessions, with the only disadvantage being the several hours I usually spend devising a schedule to ensure that most people get to attend most of the sessions they request.

Student Responses

Students in my online courses have overall responded quite positively to the increased opportunities for real time interaction offered by these varied uses of video conferencing. Anonymous, standard end-of-course student evaluations for the 13 online classes in which I have so far used video conferencing in these ways were excellent, with a weighted overall mean rating of 4.7 on a 1–5 scale (5 is best). Students also responded positively to a specific question I added on these evaluations about the use of video conferencing in the class, with a compelling majority in each class agreeing or strongly agreeing that video conferencing had been important to their learning (see Table 1 below).

Particularly significant to me were the optional comments students chose to write on these evaluations regarding the impact of various uses of video conferencing in these fully online courses. Out of 142 comments related to the video conferences collected from all these classes, 116 (81.7%) were completely positive, 18 (12.7%) were mixed, and only 8 (5.6%) were negative.

Disadvantages

The few negative comments and the negative elements within the mixed comments mainly referred to technical issues, such as dropped connections or background noise picked up through students' microphones. These were not too frequent, but not altogether uncommon either, and perhaps unavoidable among so many students trying to connect from so many places using a variety of devices.

Six students from various courses also mentioned negative experiences with the video conference-based small group work, mainly due to personal issues of the same type that tend to arise during F2F small group work:

> *I didn't like any of the small group stuff. But, it may just be that I don't play well with others...*
> *I would say that there was one student that made the [small group] experience a bit frustrating at times ...I am only saying this because the course felt small and*

Table 1 Student responses on anonymous EOC course evaluations to a specific question about the use of video conferencing

Q 16: The class sessions using [video conferencing] were important for my learning in this class.						
Term & class	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	μ(SD)
F13 EDIT6600E	11%	–	–	11%	78%	4.4 (1.3)
Sp14 EDIT6330E	10%	–	10%	10%	70%	4.3 (1.3)
Sp14 EDIT6400E	–	–	–	20%	80%	4.8 (0.4)
Su14 EDIT6400E	–	8%	15%	23%	54%	4.2 (1.0)
F14 EDIT7340E	–	–	–	25%	75%	4.8 (0.5)
Sp15 EDIT6330E	–	–	–	45%	55%	4.5 (0.5)
Su15 EDIT6600E (sec. A)	–	9%	–	27%	64%	4.5 (0.9)
Su15 EDIT6600E (sec. B)	–	8%	15%	8%	69%	4.4 (1.0)
F15 EDIT6400E	–	–	–	33%	67%	4.7 (1.0)
Sp16 EDIT6330E	–	12.5%	–	–	87.5%	4.6 (1.0)
SU16 EDIT6400E	–	–	11%	22%	67%	4.6 (0.7)
SU16 EDIT 6600E	–	–	24%	12.5%	50%	4.3 (0.9)
F16 EDIT 6400E	–	8%	15%	15%	62%	4.3 (1.0)

*This question varied slightly in wording each term, due to the use of Google Hangouts vs. BBB/Canvas for video conferencing

very personal, so I did feel personally offended by this student a couple of times.
I wasn't a big fan of the learning experience project, but that had a lot to do with my group's difficulty in coming to consensus…

Such comments suggest that instructors using video conferencing for small group work need to be just as ready to manage such issues in online interaction as they are in traditional F2F classrooms.

Advantages

On the other hand, twenty students specifically commented on the benefits of the small group interactions, most of which are captured in this longer comment from a student for whom this aspect of the course was clearly important:

I think it is very effective and helpful for learners to have small group discussions in each large group time. Due to the time limit, sometimes it is hard to talk much in the large group. So, making small groups enabled every student to have chance to talk and share their ideas within a more comfortable environment. It was also interesting to exchange ideas with other small groups about slightly different topics which were given to each small group by the professor.

Other students, like this one, mentioned how feedback and collaboration in the small group sessions specifically benefitted their learning:

I like that we had a small group to bounce things of off. A—— is really good at that type of writing, and I am not, so it was helpful to have her insight.

The majority of positive comments on these end-of-course evaluations about the use of video conferencing stated simply that it increased their enjoyment of and engagement in the class:

I loved Hangouts. I thought I would hate it, but it was interesting and fun. I never dreaded having to be there....You should definitely use it again.
I really liked the Hangouts. It was a lot more effective than any of the other courses I took [online], where it was mainly just the instructor's voice and PowerPoint (ugh, right?).
I love how we get to talk about our ideas and really get involved in the class.
Despite the technology glitches, the live video conferencing is what will keep me coming back as a student.

As the literature cited earlier would suggest, for some students, being able to actually see other students' faces was an important element of class interaction. Seventeen students commented on this specifically, saying things like:

I will attribute the success of these meetings to the use of Google Hangouts as a medium since it can show each participant's face to the group in a virtual roundtable, giving a potentially higher level of engagement than with Blackboard and Wimba (the worst of all).

Seeing the other students made them "real" for me, not just a name on the screen as in other online courses I have taken.

Fifteen others wrote more generally about getting to know people better and the sense of community they developed during the class:

Hangouts truly helped develop a sense of community and generated many great discussions. Sometimes I wanted a longer Hangout session for discussions and you surely can't say that about all classes!
I appreciated the Hangouts sessions which provided an opportunity to get to know my classmates and Dr. Knapp better, which I often miss, being an online student.
It took me while to get used to Canvas, but now I consider it…very nice to have the chance to establish a closer relation with classmates and teachers.

Perhaps my two favorite comments of all were

I didn't feel the distance in this distance education. It felt like an in-person class.
I felt like I was in a class, not just taking one.

Conclusion

Like the students quoted above, I also feel that I got to know my students much better than I could have, had I only encountered them through assignments or typed words in an asynchronous discussion forum on the LMS. Proponents of the flipped classroom instructional model are clear that its effectiveness rests not only on the use of technology to provide enhanced access to lectures and multimedia resources, but at least as much on the time such out-of-class access frees for enhanced in-class interaction among students and between teacher and students (Bergman and Sams 2012). Research in online instruction tells us that interaction among students and between students and teachers is just as vital in that setting, and my aim was to duplicate as far as possible for students in these online classes the rich interactive structures available in good face-to-face classes. Based on students' responses, this aim was met through the use of two video conferencing programs that allowed students to see each other, talk freely, and share resources in a variety of whole class and small group formats.

Compliance with Ethical Standards

Conflict of Interest The author, Dr. Nancy Knapp, declares that she has no conflict of interest.

Ethical Approval Because only data from anonymous course evaluations that are public records were reported in this article, this article does not contain any studies with human participants or animals performed by any of the authors.

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