

Meeting Divers Learning Needs – Using Interactive Videos in Higher Education

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Interactive Video (IV) is receiving increased attention in higher education in recent years. The concept of IV shifted with the development of the IV technologies, especially with the further development of the assessment and learning analytics features. This paper briefly reviews the research about IV use in higher education. It also introduces our experience in using one of the IV tools at Purdue University. Future research is suggested based on our research and experience.

Development of IV

IV has been used in higher education for several decades. Combining tutorials and simulations with reflective questions, the early IV was a supplemental learning resource that helped students to understand the abstract textbook content (Hansen, 1989). With the student self-paced learning design, early IV not only provided a medium for observation but also provided an environment for learning reflection (Hansen, 1990). However, the early IV is considered similar to computer-assisted instruction (CAI) (Hansen, 1989), which is effective in designing drill and practice of basic skills (Kulik, 1994) but failed to adapt technology to fit the needs of multiple learning preferences (Mayer, 2009).

With regard to the limitation of the early IV, Hansen (1989) pointed out the future IV design and development should include the following principles: first, it should follow a student-centered approach; second, it should provide multiple interaction approaches; third, it should serve as a model for student self-assessment; fourth, it should provide feedback to students; fifth, it should be able to monitor student progress and provide the instructor with a profile of the students' understanding; and sixth, the design should be open and allow for future revision.

Currently, the most popular IV tools in higher education are Kaltura, Camtasia, Adobe Captivate, Articulate 360, Edpuzzle, and PlayPosit (Hayden, Fleischer, & Taylor, 2017; Kolås, 2015). These tools are no longer simply a combination of video and questions. These tools intend to ensure videos are being viewed and encourage student engagement, improve retention of knowledge, and promote deeper reflective learning (Hayden et al., 2017). In addition, they provide multiple features to meet diverse teaching and learning needs, such as video editing, embedding questions, and providing feedback. These tools can incorporate text, images, external links, maps, multiple-types of quiz questions, polls, and discussions directly within the video. Some tools even include an open-source platform to encourage resource sharing between institutions. To some extent, the development of current IV tools is a good response to Hansen's (1989) principles.

The Effectiveness of IV in Higher Education

With the development of IV technology, researchers report that students in both e-learning as well as traditional classroom environments achieve better learning performance and have a higher learner satisfaction when IV is incorporated into the learning experience (Zhang, Zhou, Briggs, & Nunamaker, 2005). Compared to using traditional video in class, other research found IV helps to engage students in online class and decrease the dropout

rates when students watch the video (Kovacs, 2016). In addition, faculty believe that the new IV features contribute to increase students' awareness when watching a video, which makes it a good tool for both formative and summative assessment (Kol s, 2015; Kovacs, 2016).

Based on recent research, one of the most frequently used features in today's IV tools is in-video quizzing. Research demonstrates that using testing as a study tool improves long-term retention of learning materials (Roediger, & Butler, 2011). In addition, quizzing and immediate feedback benefits information retention in multiple learning settings (McDaniel, & Fisher, 1991; Lacher, & Lewis, 2015). Griswold, Overson, and Benassi (2017) conducted an interesting study in a graduate occupational therapy class. Without using any IV tools, the participants took online quizzes through a learning management system while they were watching the pre-recorded lecture video on another platform. They were asked to pause the video several times to take the quizzes and were allowed to go back to watch the video while they were taking the quizzes. The results show the online quizzes helped to improve student test scores in a final unit exam.

Today, many IV tools make taking quizzes much easier than this. Multiple types of quiz questions along with other interactions can be embedded into the video directly. In other words, videos and quizzes can be easily included into the same platform, without the need for students to access multiple areas in order to complete the activity. For example, Students who need additional time to work on the quiz question have the option to pause the video and review it. Students who are comfortable with the material and prefer to move quickly through it can do so as well. Captions are generally included with IV, so students who prefer to read text rather than view it have this option as well. Review features are especially important for students whose primary language is not the same as the material presented as well as students with learning disabilities.

In Cummins, Beresford, and Rice's (2015) study, an IV tool was used to design quizzes based on a series of instructional videos for a college level programming course. The researchers found the majority of student think the in-video quizzes were useful in helping them understand the video. The study also found that students interact with the videos in very different ways because of different learning styles. The researchers recommend considering student behavior and motivations when designing quiz questions using IV tools (Cummins et al., 2015). Figure 1 shows a screenshot of an in-video quizzing designed for an ESL program in a community college.

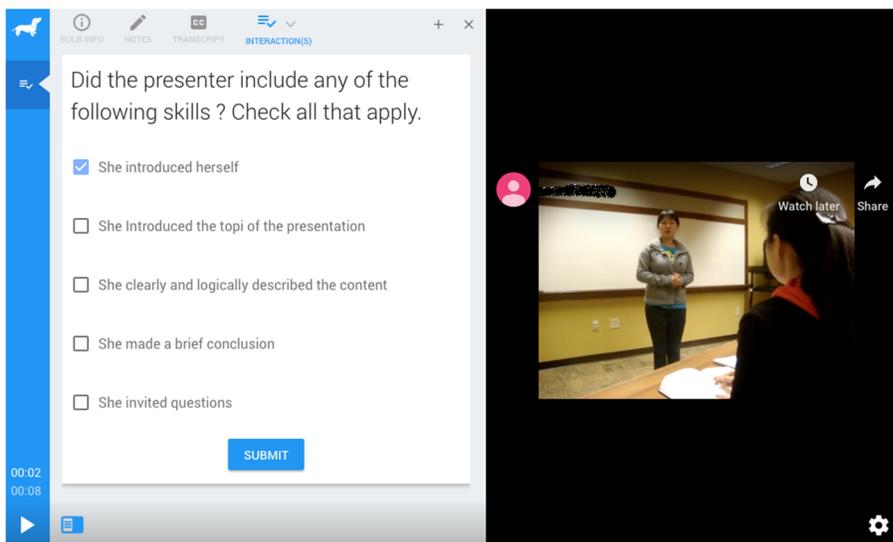


Figure 1. A Check All question created with PlayPosit.

Note: Captions are not included in this screenshot because it is the end of a student's presentation.

Another very popular feature in IV tools is learning analytics, which helps instructors understand and optimize learning and the learning environment by measuring, collecting, analyzing, and reporting data about learners and their context (Long & Siemens, 2011). Most of the aforementioned IV tools provide analytics on both course-level and individual-level. Course-level analytics show how the class is progressing with each of the activities and each of the quiz questions (Blackstock, Edel-Malizia, Bittner, & Smithwick, 2017). Faculty can use analytics to determine what to cover during class time for ensuring the specific needs of each class are met. Individual-level analytics show student understanding, level of effort, and other related learning behaviors on each

of the activities and quiz questions (Hayden, et. al 2017). This information can be used to identify struggling students for additional support before the student becomes too far behind.

However research also shows the limitation of some IV analytics. A study conducted in a postsecondary level medical course shows the standard generic and direct feedback responses that some IV analytics provide do not meet students' multiple learning style (Ovalle, Schofield, O'Hara-Leslie, & McLain, 2017). To effectively improve learning, students who interpret the quiz questions differently need a specific explanation for why their answer is correct or incorrect (Ovalle, et al., 2017).

The current study on IV analytics is still limited. More research about student/faculty perceptions as well as the effectiveness and usefulness of IV analytics is needed in the future. Figure 2 and Figure 3 show PlayPosit's learning analytics at course-level and individual-level, respectively.



Figure 2. Course-level Learning Analytics

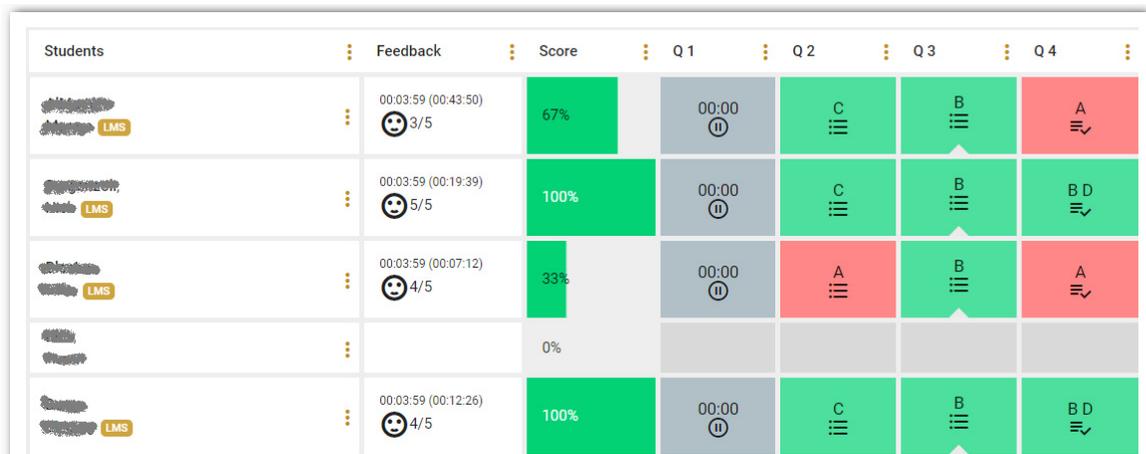


Figure 3. Individual-level Learning Analytics

Although a number of studies claimed IV tools effectively improved learning outcomes (Hayden et al., 2017; Kolås, 2015; Kovas, 2016; Zhang, et al., 2005), there still some studies show no difference between using IV tools and using other teaching strategies on student test grades (Bennett, 2018; Lacher, & Lewis, 2015). Researchers point out students grades are not sufficient in assessing the effectiveness of IV in education (Austin, Lawson, & Holder, 2007; Lacher, et. al., 2015). Additional factors, such as the nature of the instructional content, instructional methods, and related instructional material should also be considered (Hattie, 2009). In addition, researchers suggest future studies focus on comparing perceived learning styles and performance on testing (Bennett, 2018), evaluating and analyzing a wide range of activities rather than focusing on a single assessment (Kolås, 2015), and investigating how students engage with the IV materials (Cummins et al., 2015).

Using IV Tools at Purdue University

Purdue University has been using instructional videos in different learning environments, including face-to-face, fully online, and hybrid courses. Most of these videos are pre-recorded lectures/instructions, which are used as required learning tasks for preview and overview of specific topics. Many faculty want to use IV tools to make these traditional videos more engaging to all types of students. Our needs assessment shows we have more than 30,000 full time undergraduate students and 9,000 graduate students, including about 9,000 international students from 122 countries. A total of 7,085 students participate in some form of distance or online learning. In addition, over 100 faculty are from non-English speaking countries. With regard to this situation and the aforementioned instructional video use at Purdue, we decided that the IV tool that we choose needs to include the following features:

- allow closed captioning;
- allow embedding instructions, comments, interactive communications, and assessments;
- force watching without skipping any part of the video;
- include assessment analytics;
- allow integration with Blackboard Grade Center.

Prior to PlayPosit, Purdue had been using Kaltura as a video production tool. As mentioned before, it is also a commonly used IV tool in higher education. However, the limited interaction feature in this tool cannot meet the teaching and learning needs at Purdue. Based on our market analysis, we chose to pilot PlayPosit. Compared to Kaltura, PlayPosit provides more detailed learning analytics and multiple interactive activities, which helps faculty create instructional materials to meet diverse learning needs in both online and face-to-face class. In addition, it can be used as a class engagement tool that can collate real-time student responses in face-to-face classes. Table 1 shows a brief analysis of these two tools.

Table 1.
Comparison of three different IV tools used at Purdue University

Features	PlayPosit	Kaltura
Video Editing	Yes	Yes
Authoring Interface	Users need basic training	Users need basic training
Search Public Video	Yes	No
Upload Video	Yes but has limitation on size	Yes
Caption	Yes	Yes
Integrate with Blackboard	Yes	Yes
Types of Interactions	Multiple choice, Y/N, free answer, poll, discussion, reflection, etc.	Multiple choice only
Course Copy	Need to re-assign the link	Easy to copy
Learning Analytics	Detailed analytics for individual students and course level	Very limited analytics
Accessibility	Passed accessibility check	Passed accessibility check
In Class Engagement	Yes	No

Although many faculty showed interest in this new tool, we had difficulty finding users in the first semester. We hosted two campus-wide showcase events in order to provide information about the tool and identify potential faculty interest. Research shows the main barriers to video use in higher education are course development time and professional development in the technology (Leahy, 2015). So we provided faculty ample time to consider how they might incorporate IV in their courses, and we provided professional development through technology training and instructions on facilitating course design with this tool. With the help of our pilot team, some faculty created a few sample videos for their summer courses. Most of these faculty decided to create course-wide activities and assessments with this tool for the following semester. Through direct assistance with the process, we found faculty use this tool differently in their classes. The learning materials that are created using this tool can be concluded in the following categories:

- for pre-view and review
- for online class instruction
- for observation and reflection

- for formative assessment
- for taking attendance
- for lab tutorials

We have several successful use cases during the two-year pilot. For example, in a college level planetary science program, the instructor initially used one interactive video in a course that he had previously taught. He used this as a way to assess effectiveness as compared with his previous teaching method for that particular content. This trial IV was used to provide an interactive online resource students could access on Blackboard as part of a face-to-face course. The instructor discovered that IV provided a good way for him to provide low-stakes, formative assessments for his students. This was important to him because his course is based on mastery of the material and his teaching philosophy involves allowing students to have multiple opportunities to demonstrate mastery. He set his IV to allow students to retake the embedded quizzes as many times as they liked. He is currently using IV as a major component of his totally online version of this course. Each interactive video is only worth a small percent of the grade, but it is one of many ways for students to perform a self-assessment of the material as well as to demonstrate mastery.

During our pilot, most feedback from faculty focused on questions about IV material design and development. However, we also found that several technical barriers prevented some faculty from adopting this tool in their classes. These included: 1), limitations on size and video type that can be uploaded within this tool; 2) video links breaking during course copy; and 3) limitations in allowing multiple users, such as instructor and teaching assistant, to create/edit a same video. These problems increased instructors' workload when they were trying to adopt this tool in their classes, especially when they were trying to create a large number of IV for a single course. Since only a few faculty created formative assessments with this tool, there was no issue reported in learning analytics.

We have documented several lessons learned in order to decrease barriers to implementation. We suggest the following: 1) faculty limit video length to limit file size; 2) institutions use the most current LMS releases in order to avoid system bugs that can create issues like links breaking; 3) IV developers provide permissions or roles that allow faculty and teaching assistants to work together on common video assets without compromising security of video assets for other courses. We also recommend that faculty begin with creating a trial interactive video before revising an entire course using IV. This gives the instructor an understanding of the time and effort it takes to create an interactive video. It also provides an opportunity to discover the most effective ways to incorporate various IV features within a particular field. Once an instructor has discovered what works and does not for their specific course, additional IV can be created, minimizing revisions and wasted time.

Conclusion

Based on our research and experience, a good IV tool needs to be easy to use and provide multiple interactive activities to meet multiple learning needs. It should be seamlessly integrated with a learning management system, provide dynamic feedback to students, and be able to provide detailed individual/course level learning analytics. Researchers point out that taking advantage of the multiple forms of interaction and communication should be considered as a goal for IV future development (Ovalle et al., 2017). Therefore, more research studies are needed in evaluating different types of IV communications and activities (Kolås, 2015) and how students engage with these IV materials (Cummins et al., 2015). In addition, multiple factors, such as instructional content and instructional methods, need to be considered in the future studies (Hattie, 2009). To get the best use of IV tools, more research about faculty perception as well as the effectiveness and usefulness of IV analytics is also needed in the future.

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