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Using Flip camcorders for active classroom metacognitive reflection

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Abstract
A Center for Teaching and Learning provided Flip camcorders to a group of 10 new faculty members, who were asked to use this teaching tool in their classroom instruction. The classes included mathematics, political science, computer engineering, psychology, business, music and dance. The qualitative results indicate that all faculty members and many students enjoyed the experience. Faculty identified innovative methods to integrate the camera into their classroom teaching, which resulted in more engagement and positive student outcomes. Several faculty members developed methods, procedures, assessment rubrics and guidelines for using the Flip in assignments. The major finding may be the breadth of generalizability for the use of this tool across disciplines for increasing student engagement. The primary goal of this research is to provide data on one of many emerging technology tools to help faculty exploring potential devices for continued improvement and understanding of how we learn.

Keywords
active learning, digital camera, instructional technology, interdisciplinary, metacognition

Learning objects, information processing and metacognition
The use of learning objects in class to increase attention, engagement and subsequent learning has been cited often in the literature (Koran et al., 1984; Koran et al., 1990). Informal learning settings have a long history of capitalizing on hands-on research, which indicates that we typically learn better and deeper when we are involved with our senses, especially with more than one. A significant level of sensory stimulation, and subsequent attention to the stimuli, influences how we process, retain and use information gained from environments similar to informal learning settings (Koran et al., 1983). Engaging our senses initiates the first step of information processing, the stimulus, which if sufficient may sustain attention. Shettel (1996) realized that, in order to hold attention, thereby increasing the chances of further processing, time on task, or holding power, has been found to be one of the most useful predictors of educational effectiveness. Providing students with an object such as the Flip camera engages their senses and holds their attention in a unique and enduring way. Using a visual tool such as the Flip addresses our sense of sight or perception, a common attribute of attention and important...
component which occurs prior to coding information. Bodecker (1995) indicates that perception is an active process, which is typically the result of hypothesis formation and testing conditioned by our expectations. Ultimately, attention is critical as a precursor to learning, and in addition it enables both coding and decoding of subsequent retrieval of information (Boronat and Logan, 1997).

The ability to consciously think about how we are processing information, or ‘thinking about thinking’ (Yussen, 1985), is our own metacognitive ability. Reflection is an ideal activity to encourage metacognitive insight and continual monitoring of what we know, how we know it and if we need to learn additional information to fully understand the conceptual framework. Glynn and Muth (1994) have shown that when students ‘think out loud’, they are able to reflect on their reasoning process, which results in greater connections to the material and subsequently the ability to use the information in context.

In addition, using various technologies such as analytical probes, scientific calculators, digital cameras, scanners, student response systems (clickers), iPods, Smartphones and more has been seen to create novel stimuli, attract and sustain attention for deeper connections between working and long-term memory. The methods and dynamics of the tool can provide additional data for capturing certain types of learning. The ability to place technology teaching tools in the hands of students and quickly allow them to assess their own as well as their colleagues’ learning in a formative, real-time mode is powerful (Dawson et al., 2009).

Technology-oriented learning objects

The integration of technology driven teaching tools may have began with the first portable calculator in the hands of students during class. The integration of mobile technology into the classroom has escalated exponentially introducing scientific probes, personal digital assistants, Smartphones, digital cameras, scanners, iPods, Kindles, clickers and more. Johnson et al. (2009) remind us in the 2009 Educause Horizon Report that students now hold in their hands every day ‘a single portable device that can make phone calls, take pictures, record audio and video, store data, music, and movies, and interact with the Internet’. Furthermore, the report indicates that within a year many of these applications will have specific and pertinent uses in educational settings. The report also has a section on ‘Relevance for Teaching, Learning, or Research’ that shares specific examples of how mobile technology has integrated into the higher education classroom. The disciplines which are using these devices include computer science, mathematics, medicine, and music. The Educause website also has created a practical information service, which shares brief information on emerging instructional technologies. They provide two-page pdf files called ‘7 Things You Should Know About . . .’ (Educause, 2009). These highly digested resources contain seven standard sections: What is it? Who’s doing it? How does it work? Why is it significant? What are the downsides? Where is it going? and What are the implications for teaching and learning? For instance they see the Flip as an excellent choice for ‘instruction and assessment – in which mastery of a skill can best be demonstrated through video, including such fields as chemistry, nursing, dance or visual arts’ (Educause, 2009). Other topics for this series include Second Life, Wii, Google Apps, lecture capture, Skype, Twitter, YouTube, blogs, wikis, podcasting, clickers and social bookmarking.

Significant research has been completed on various technology-oriented mobile learning objects and their potential to enhance teaching and learning:
• Digital cameras – the University of Central Florida (2006) has created a website ‘101 uses for a digital camera’, which shares discipline-specific lesson plans and allows the user to submit their own, and faculty at the University of North Florida have created an online resource entitled ‘Digital cameras in education’ (Cavanaugh, 2006).

• Digital scanners – historically scanners were used to help move our hardcopy resources into a digital format for subsequent editing and use in presentations, sharing and learning. One unique use was for students in science classes to capture a digital image of their favorite bug. To do this, the student would capture the ladybug, grasshopper or cockroach, place it in a refrigerator for an hour to slow the metabolism, then place the insect inside a hole cut from a mouse pad on a scanner. This resulted in a high-quality, individualized electronic file.

• Student response systems (clickers) – Vanderbilt University has collected an extensive list of resources, literature and discipline specific uses for clickers in the classroom (Bruff, 2008).

• iPods (podcast/vodcast) – Duke University led the charge by offering its entire freshman year a free iPod for their learning in 2004. They have created an extensive evaluation report (Duke University, 2004).

Although much has been addressed in the past decade on integrating instructional technology into the active learning classroom, there are still additional specifics which require attention. For instance, how technology can attend to processing information. Deploying a technology-oriented teaching tool in a manner to collect data and add to the literature is a positive step in developing the overall picture of how these tools can enhance learning.

Background

Ten Flip camcorder video recording devices were purchased by the Center for Teaching and Learning at the University of the Pacific and distributed to newly hired faculty members who expressed an interest in exploring new methods of engaging students through the use of innovative technology tools. These faculty members responded to an open advertisement on using new technology tools, and each faculty member who responded and met for the initial training received a Flip camera. (The Center has a limited amount of funding provided by the Provost Office for these initiatives.) Faculty members involved in the project met monthly to discuss their projects, as well as communicating periodically through email communication. One of the goals of the Center is to identify and assist faculty members in using emerging technology for instructional enhancement. The Flip camera is a relatively new technology and was selected for its simplicity, ease of use and potential power as a learning tool (Figure 1). An initial meeting was held early in the spring term in which faculty members were instructed in the basics on how to operate the system, record, download. Faculty were then asked to develop and implement ideas on how to use the device in their teaching and learning, subsequently sharing the ideas and outcomes, challenges and impacts on student learning. Continued support from the Center was provided on an as-needed basis. The intention was to explore potentially innovative ideas for engaging students as well as to offer an increasingly diverse learning environment to students. A major goal was to encourage faculty members to reflect on their teaching, especially on ways to provide additional opportunities for students to interact with the material in new ways. The desired results would be that students would embrace and share their engagement with others, and faculty members would acquire an ability to translate this method to other instructional tools.
Methods
The methodology for this study included soliciting 10 new faculty members from different disciplines who were interested in enhancing their teaching and learning by use of an appropriate instructional technology tool. The study was conducted in the spring term at various classrooms around the campus and on a time scale controlled by the instructor. Each faculty member was given a small portable Flip video camera, trained how to operate the simple device, followed by a brief brainstorming session on ideas to capture student activities and subsequently use the data for reflection, remediation, and insights. The participating faculty members included six female and four male teachers from different disciplines, who self-selected into the program. There was no control, or formal experimental design, since the focus was simply on gathering data from a wide range of experiences, identifying trends, sharing ideas which worked well, and possibly further exploring and expanding on the successes.

The following section summarizes the various faculty members’ disciplines and the activities for which they used the Flip in the classroom, as well as giving commentaries on the effectiveness and the challenges. The disciplines represented in this study were business law, computer science, dance, education, engineering, mathematics, political science and psychology.

Results – discipline-specific examples
Business law
Through the implementation of the Flip camera, students were provided with quick visual evidence of their oral presentation styles as well as their effectiveness in disseminating a coherent,
articulate argument/presentation. Though the class verbally reviewed each student upon completion of their presentation, the viewing of the tape in the privacy of their home may have produced the most effective manner of changing both behavior and delivery style. Students noted that the self-analysis had beneficial aspects which often resulted in improved behavior. Improved engagement was apparent throughout this course. Students, unsolicited, stated that they felt more comfortable speaking before groups after having the Flip camera analysis and after being forced to make so many presentations. Students actively altered their speech patterns in presentations as well as in daily conversations; many tried to stop saying ‘like’ and ‘um’ in a habitual manner. Not only did their presentation styles improve, but the content delivery and organization of the speech improved. The Flip technology helped students learn, and they appreciated the real-time feedback. In addition, the camera is easy to use, containing only a few buttons, and resulted in an adequate picture quality.

**Computer science**

Approximately 20 video clips were produced using the Flip camera, which included group discussions. These can be especially useful for students who missed the discussion. Mini-presentations were also captured and presented to all students. Although the students were not accustomed to viewing themselves in the videos, when they were informed of the videoing prior to their presentation, they became more serious and professional. One student who is always quiet in class actually spoke out in front of the Flip. Different solutions were recorded showcasing students solving a problem. The videos were made available online so that students could view them anytime. Future plans include using the Flip for conference attendance, capturing relevant presentations to include in class lessons. In addition the Flip can be used for recording field trips for later class discussion, and recording hands-on activities of students in other classes.

**Dance**

The Flip camera assisted in the teaching of dance and choreographing. In the future, it will be used to capture the first day of class movement to the last day, which will visually and dramatically show student improvement. The rapid visual aid allows for immediate feedback for student and instructor, so real-time remediation can occur, especially in the critical arena of lighting in the theatre. Many of the videos were produced to show an exact exercise but from opposite sides for comparison. For example, in one video (advanced dégagé with port de bras) the dancer can see how high the foot is coming off the floor but cannot always feel it. Different teachers use different height preferences and height builds for different muscles in different steps. This video shows arm movement with leg movement where the transition should be smooth. It is then easy to see that the legs are moving fast in all directions; arms should be soft and smooth, which is a difficult task to accomplish simultaneously.

**Education**

The Flip was used to record student presentations, which will be shown to subsequent classes to assist their vision of expectations. Because the presentations were in an area that is changing quickly in school psychology, it will be interesting to compare them later. An exceptional feature of the Flip was the ease and efficiency of downloading the presentations to a laptop for quick viewing and editing. The unanticipated outcome was the extent of student engagement and excitement
when the Flip was used. Their presentations were more professional than they would have been had they not been recorded. In the future, the Flip will be used in combination with the iPod Voice Memo feature to help students in interviewing children and their teachers. It will be a significant benefit to be able to quickly and easily critique each other in class. The Flip allows a critique on not only verbal but also non-verbal communication skills. The students learn by practicing these skills and receiving immediate feedback on their development of the interviewing skills.

**Engineering**

The Flip camera was used for Civil Engineering students in Reinforced Concrete Design in order to accomplish the following objectives: (1) identify, formulate, and solve reinforced concrete design and analysis problems; (2) communicate solutions for engineering problems verbally and visually; (3) explain complex subject matter to peers; and (4) provide alternative means to review concepts.

The class was asked to create videos on specific analysis and design problems learned throughout the semester. Each group prepared a video identifying the ‘given’ and ‘find’ aspects of a problem statement, detailing the solution procedure and making references to the American Concrete Institute (ACI) Building Code 318. Several of the students also utilized the Flip camera to record video and audio during site visits associated with their Senior Design Projects. In addition, competitors in the Pre-stressed Concrete Institutes Big Beam Competition (design, analysis, construction and testing of a 17-foot pre-stressed concrete beam) used the camera to record the fabrication and construction of their project at the industry sponsor site.

Students used the Flip to record themselves solving an example problem on paper or on a white board and sharing references to the corresponding ACI code section. Videos were generally 20–30 minutes. The videos had to include an introduction, identifying given values; an approach; a solution; and a summary. The videos were assessed based on (1) accuracy of the problem and statements, (2) verbal explanation, (3) visual aids, and (4) comprehension. The following are some student comments on the experience:

1. What did you like most? What did you like least?

   ‘I like that we could work in a group and talk about the approach to solving the problem. It helped me understand the problem better. I also liked learning how to explain a topic; the ability to work through the problem at my own pace and better analyze it; that we got to pick the topic and use old homework. I like the creativity associated with the video; and it was something different than homework.’

2. How would you change or improve the video assignment?

   ‘What I would do is try to assign more than one problem so that both students can have a chance to do a problem each. I don’t know. Allow a lower maximum time for the video. I would not watch a video if it was more than 15 minutes.’

3. What other ideas or suggestions do you have for incorporating video into the classroom?

   ‘I think showing the videos in class would be nice to know how the other students explained their problems and what they could do to improve in the future. Post your own on YouTube. Use video projects for having us go out and look at buildings and narrating. Use it for days you are sick or for midterm reviews. Capture video of beam and column construction. Maybe assign it as for throughout the semester with one video due each week by a different group.’
Mathematics

The Flip was used in three mathematical courses, two Calculus III and a Chaotic Dynamics and Fractals course. Daily definitions and theorems were illustrated, followed by exercises that students discussed and solved during class. During these problem sessions, the Flip was used to capture their process. The videos were displayed in class as a teaching prompt as well as archived online. The Flip was ideal for teaching the concept of cutting a three-dimensional object in slices and finding the level curves for the object. First students drew the level sets of their own faces, heads, and bodies. They had to imagine the curves that one would get when cutting a face in thin slices (www1.pacific.edu/~smarotta/Spring2009/MATH55/Videos.htm).

One of the best uses of the Flip was related to the study of fractals. Fractals are mathematical objects that have the property that when one magnifies a portion of them one sees the whole object. Examples of fractals in nature include trees, clouds, and cracks on the ground, rivers and mountains. Students were asked to go outside and ‘fractal hunt’ using the Flip camera. Groups returned with more than a dozen movies each, which are available on our course webpage (www1.pacific.edu/~smarotta/Spring2009/MATH193A/Videos.htm).

On the last day, students completed an attitudinal Likert post-survey that consisted of the following questions [scale: (not at all) 1 2 3 4 5 (very much)]

1. Do you believe using the Flip camcorder helped you to understand a math concept?
2. Did using the Flip camera increase your engagement in class?
3. If given the choice in the future, would you use the Flip camera in class?
4. Share any other comments you have about the use of the Flip camcorder in class.

Average results for the data produced values of 2.67 for question 1; 3.0 for question 2; and 2.67 for question 3 from the Calculus III morning class \( (n = 18) \). The afternoon Calculus III class \( (n = 17) \) data resulted in higher values of 3.21, 3.89, and 3.68. The Dynamics class \( (n = 3) \) had similar data to the afternoon Calculus III class of 3.0, 3.7, and 4.0.

Student comments:

The Flip allows us to see other students work, but sometimes its hard to see the videos.

It is good to see what students are doing. It is not extremely useful but it does help sometimes.

It was good to be able to go back and see what was done before, cool to visualize others work.

It made it easier to understand images when I could see what others were doing.

Good for use in lab projects.

Within camera recording, I have the chance to (experience) the working process of my classmates besides their opinions. This is particularly helpful to improve my understanding by exposing me to different views.

Political science

Ten student presentations were recorded using the Flip camera. The presentations were research projects for department capstone courses. The goals were to (a) show students how they present when giving a formal presentation; and (b) record the feedback students received. Feedback on the results included the need for a tripod to help stability and therefore video quality; consideration of
file size, which may be too large to post or email (12 MB/minute of video); audio quality may be a concern, as the presenter needs to be relatively close to the camera; about five presentations could be captured on the device before having to offload to a computer; and the battery was more than sufficient for the three-hour class.

Psychology

The Flip was used to record students as they gave 60-second practice presentations in class. The purpose was to get them used to presenting to the class and talking about the topic they would be presenting in a longer presentation at the end of the semester. Immediately after the presentation, each video was downloaded. While the download occurred, the class rated three major areas of the student’s presentation using clickers. Once the video was downloaded, the class watched the video. The student who presented was asked to identify one key area of their presentation that they would work to improve. The entire process took approximately three minutes per student.

Discussion

The major message which others can take from this work and apply to their own teaching is that the type of instructional technology available today has become extremely simple to use, cost effective and can be used to increase engagement and student reflection (metacognition). Here are some suggestions for others to consider in maximizing the potential of using a technology teaching tool such as the Flip camera:

1. Just try it! Once faculty members had these in their hands, they found themselves using the tool, as opposed to borrowing a video camera, trying to learn it and then digitizing the product for use at a later time.

2. Let the students take the lead. Across the board, the faculty members shared that the students quickly acclimated to the new tool and offered suggestions on use and assistance in the operation.

3. Don’t be afraid. The Flip is almost unbreakable, and the worst thing that can happen is that one loses data; however, since the Flip only records one hour of video, the most that can be lost is one hour.

4. Embrace the lower quality. Many of us have become accustomed to high definition television, movies, and video games. However, the ‘rawness’ of the Flip camera actually works in our benefit, as students are not as focused on the quality as they are on the acts that are being captured.

This experience can lead to further reflection about teaching and learning. Teachers can create an environment where students can learn and where such experience generates long-term learning in the students. The need for having feedback may be alleviated by the use of more methods of feedback, especially those methods that are recordings of real situations. Using the Flip can create the possibility to contrast thoughts with actual events.

This was a great opportunity to start thinking about teaching and learning in a different way. It was also a good experiment about being more dynamic in teaching and being open to try new things. Changes in technology influence the kind of jobs and activities that a person can do in their life. Appreciating changes in teaching is an important part of the learning experience. Teachers need to embrace the possibility and responsibility to introduce new technologies in the classroom.
as well as to be critical and reflect about which are the best ways to create productive environments for learning using the given technologies.

We believe something that others can take from this work is that faculty members are not only interested in trying new pedagogically based technology tools, but they are also secure enough to integrate them into their current courses, and collect data on their effectiveness. Most of the time, faculty either do not attend to this aspect of modifying their methods and/or there is not a central, collating department or responsible person to provide the tools, direction, structure and ultimately prepare the outcomes in a useable format for others. Therefore, encouraging a Center for Teaching and Learning, or possibly a designee in a department, to assist in this type of data gathering can be beneficial.

There are limitations to every study and ours is no exception. Limitations include insufficient empirical data correlated to measurement and evaluation; a small number of participants; short study time period; range restricted sampling and self-selected faculty members; and less-than-systematic methodology for soliciting, selecting and deployment of the technology tools. However, all research requires a starting point from which to build, and we believe that this research has resulted in sufficient data to demonstrate that further work is merited to fully understand and determine the potential use of technology tools such as the Flip in the classroom.

As part of continuous improvement, teachers may need to reconsider teaching methods and integrate appropriate functional technologies at times. Students are open and enthusiastic about the use of new technologies in the classroom, which is an aptitude that can be capitalized on to access various learning styles. Many students are digital natives and may be more open to adapting their learning of a new concept if they can relate to a technological component. The integration of new technologies frequently requires a confident instructor who is able to experiment and subsequently reflect and analyze before fully implementing the strategy.

Ultimately, this research added to the current extensive literature base on viable instructional technology tools and possibly filled a small, but important, gap for some instructors on the possible use of a portable device such as the Flip camcorder. The intent was not specifically to identify the use of a Flip, but more importantly to help faculty members see the potential in using a rather ubiquitous device to further address and explore the foundational theoretical frameworks of how people learn.

Suggested further work in this area includes dissecting the data for trends that may lead us to believe some disciplines may work better for this approach than others; identifying other instructional technology tools, which can be portable and placed in the students’ hands; connecting the video products to other literature bases, such as storytelling, and possibly suggesting that the instructor and/or the students create storyboards of their work, in an effort to further synthesize and reflect on the data; and implementing the new high-definition Flip camera to compare quality and the effects of quality, especially for the mathematics and other disciplines who noted problems with students viewing the written work captured on the camera.

References


**Biographical notes**

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