Learning Hands-on Skills in an Online Environment: The Effectiveness of Streaming Demonstration Animation

Dr. Shiang-Kwei Wang
New York Institute of Technology

Abstract

Online learning courses are generally text-based. Particularly for students who are learning multimedia skills, these courses can be problematic because demonstration and hands-on activities are important in the field of multimedia authoring. This study uses action research techniques and describes the application of onscreen-action-capture software to the design of hands-on demonstration animation. This article (1) explores the teaching of multimedia skills in an online learning environment, (2) compares the use of the software in an online learning environment to use of the software in a face-to-face learning environment, and (3) proposes strategies by which instructors can encourage students to complete hands-on activities in an online learning environment.

Purpose of this study

In recent years, more and more educational technology programs have shifted the learning environment from the face-to-face classroom to the online learning environment. A national report (National Center for Education Statistics, 2003) indicates that during the 2000 and 2001 academic year, 56 percent of all 2-year and 4-year post-secondary institutions offered distance education courses, and the number is growing.

In a typical educational technology program, a required computer-skill course is multimedia authoring, and some programs even demand that students take more than one computer-skill course. According to Webopedia (2005), multimedia authoring enables designers to create a final application merely by linking together objects, such as a text's paragraph, an illustration, or a song. By defining the objects' relationships to each other, and by sequencing them in an appropriate order, authors (those who use authoring tools) can produce attractive and useful graphics applications. Most authoring systems also support a scripting language for more sophisticated applications.

The completion of multimedia courses ensures that students' skills and knowledge align with the five AECT (Association for Educational Communications and Technology) standards (Earle, 2000): design, development, utilization, management, and evaluation. When teaching multimedia authoring skills, the programs' instructors provide the students with lab sessions, which enable the students to conduct many hands-on activities. In this learning-by-doing process, students should observe the instructors' demonstrations and should have the instructor review their projects. Moreover, these students should become active participants, involving themselves in activities instead of being passive message receivers. Therefore, the learning-by-doing approach carries with it the expectation that there is a great deal of interaction between the instructor and the students.

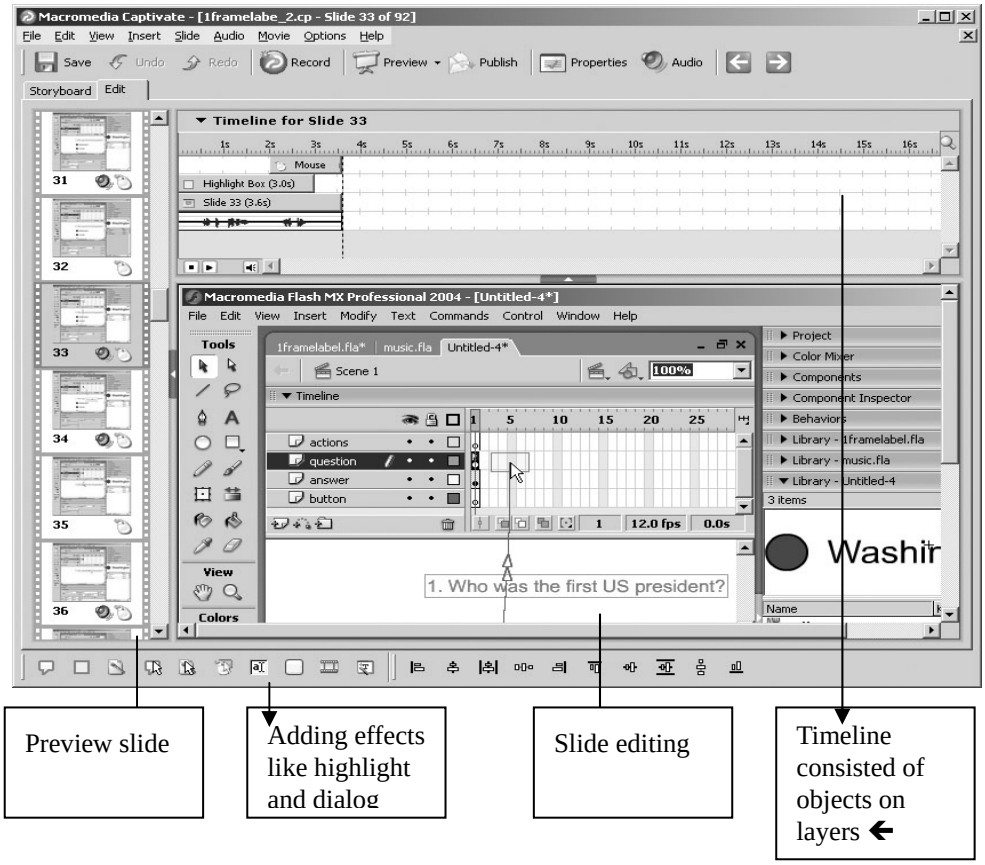
As more programs offer multimedia courses in online environments, issues and difficulties emerge. There are certain obstacles to the effective delivery of online training sessions: for

example, participation is hard to monitor, and group activities (other than discussions) and hands-on activities are difficult to implement (Wang, 2005; Zirkle, 2000). And online training, because it is a new learning form, may be difficult for programs to implement, particularly with regard to factors such as communication methods, information formats, and trainers themselves (Huang, 1997).

In the face-to-face or hybrid learning environment, the instructor can correct students' work immediately and can make sure that the students follow demonstrations carefully and perform hands-on activities adequately. However, in an online learning environment, the difference in time and space between the instructor and students complicates the instructor's efforts to ensure that students master the hands-on skills. Previous research pointed out that the student withdrawal rate is higher in online courses than in face-to-face courses (Dutton, Dutton, & Perry, 1999; Ridley & Sammour, 1996), a finding to which I, as a former online teacher, can relate. In an online multimedia authoring course, the project-completion rate is usually lower than the rate for a face-to-face course. The literature suggests that the withdrawal rate is one measure of an online program's effectiveness (Willging & Johnson, 2004). For a multimedia-authoring course, which usually is project-based, the project-completion rate itself is another indicator of an online program's effectiveness.

To improve both the project-completion rate and the quality and to reduce the withdrawal rate, I decided to adopt onscreen-action-capture technology to imitate a face-to-face, hands-on demonstration. After evaluating the current available technology, I adopted specifically Macromedia Captivate© to record onscreen actions and to create web-based streaming demonstration animation. Captivate enables instructors not only to capture onscreen actions but also to add comments through dialog tools and to highlight parts of the animation through highlight boxes. The ensemble of these functions enables instructors to emphasize important procedures for the students (Figure 1).

Figure 1: Interface of Macromedia Captivate



To examine the effectiveness of this technology in support learning, this study employs the techniques of action research, with which educators can better explore the effectiveness of strategies, methods, and in-class materials and, thus, can better resolve a practice-based problem (Kuhne & Quigley, 1997). Action research is considered an important research approach, particularly as it concerns the issue of technology and learning (Kortecamp & Steeves, 2002). In this paper, I attempt to answer the following research question: How did adopting streaming demonstration animation affect instructional technology students' learning of multimedia authoring skills in an online environment? The expectations of this study are that instructional technology students in an online environment will exhibit student-withdrawal rates, multimedia project-completion rates, and quality levels that are similar to the corresponding rates and levels of students in a face-to-face environment.

Methods and Techniques

Participants and Instructor

Students enrolled in this educational technology masters program in a northeastern institution are required to take a multimedia-authoring course. The participants consisted of 10 graduate students in the online session and 17 in the face-to-face session. All 27 students were in-service teachers ranging in age from 21 to over 40 and all of whom had teaching certificates. The reason that the first group of in-service teachers took the online class concerned the

remoteness of their home campuses. Because they had to teach during the daytime, taking an online class was the best solution to their specific problems. The delivery of online multimedia authoring saved students time and energy that would otherwise have gone into a commute; however, the absence of both observable demonstrations and hands-on activities became a serious obstacle as the lessons advanced.

As the instructor, I had had several years of experience in multimedia design and had participated in several award-winning multimedia development projects. These experiences have enabled me to share with the students the most effective methods that underlie multimedia-skill learning.

Course Goals

The curriculum of the multimedia-authoring course was in line with the AECT standards. After taking this course, students should be able to define an instructional problem in a context, apply the instructional design principle to the design of curriculum, and develop an interactive learning module with a multimedia-authoring tool that incorporates multimedia elements such as animation, sound effects, and video clips. This educational-technology program requires students to design interactive instructional courseware by using Macromedia Flash©, which is a highly interactive multimedia-authoring tool.

To measure the quality of students' projects, I distributed a rubric at the beginning of the semester (Figure 2). According to the rubric, the projects have to include all components required to help users learn about skills in a specific domain. These components include at least a title page that displays the project's structure, a tutorial or help page that gives users directions regarding use of this tool, lesson units that cover a topic, and assessment that provides feedback to the users. To prevent their multimedia projects from becoming an electronic book (the only interaction between the user and the tool is page turning), I required students to design interactive activities (for instance, roll-over animation and drag-and-drop activities). The interface design should be friendly and could navigate users easily through the entire tool.

Figure 2: Rubric to assess quality of multimedia projects

Criterion	Low (0% to 35%)	Medium (36% to 70%)	High (71% to 100%)
Instructional component	The majority of the project is incomplete.	The project includes part of the components (title and instructional units).	Include all necessary components: title, help screen, instructional units, feedback or summary page, and credit screen
Instructional design	The project was irrelevant to the instructional unit and was not designed based on the storyboard.	Only parts of the instructional goals were served.	Accomplished its intended instructional purpose and was designed based on the storyboard.
Interactivity	The interaction is electronic book format and lacks of rich interaction.	Few interactive activities were provided and no feedback is given to the users.	The instructional activity is highly interactive. Feedback is provided base on the users' interaction (E.g., roll over animated button, quiz…).
Interface design and navigation	Difficult to interact with the project. Buttons and links are unfunctional. Did not remain consistency.	Some buttons and links are unfunctional. Interaction was not smooth. Consistency was not remained through the project.	Easy to navigate through the project. No broken or unfunctional links. Navigation is clear and intuitive. The interface design remains consistency (E.g. color and position of the button, position of feedback…).
Multimedia elements	Information presented only in text format.	Use animation to explain part of the concepts.	Use text, animation, sound, and connect to extra resources from the Internet.
Aesthetics	Difficult to read text (e.g. too bright, too small…), the imported pictures were not carefully processed (e.g. the background is not removed).	Carefully designed the presentation of information (text and picture), including color, alignment, position, etc.	The overall design of the project was appealing.
Delivery	The files were incomplete (Should include project homepage, design document page, SWF and FLA file).	Use no preloader. All files are provided. All necessary files are provided.	Use preloader to display the status of downloading and all necessary files are provided.
Extra credits	Incorporated any of the following design: drag and drop, assessment (quiz), input text (dynamic text), or any other components showing the designer have made a significant effort to produce it. Showed significant evidence of originality and inventiveness. The majority of the content and many of the ideas are fresh, original and inventive.		
Score			

Procedures for Face-to-face and Online Conditions

As the instructor, I developed an action plan by following the action-research processes to resolve the problem-planning, the acting, the observing, and the reflecting. The processes comprise five stages: assess students' capabilities and prior knowledge, select appropriate

technology, design curriculum, create demonstration animation (learning modules) on the basis of onscreen-action-capture software, and implement the materials in two classrooms, one a face-to-face classroom and the other an online "classroom." I then investigated the extent to which demonstration animation improved or had a positive effect on students' multimedia-authoring hands-on skills, and I was planning to revise the plan according to the results.

Typical learning process in the online learning course:

Stage 1: Develop intimacy. In the web-based lesson system (Blackboard), students introduce themselves, and the instructor gives them an overview of the multimedia-authoring class. Each student is assigned to a design buddy so that they may discuss the progress of each other's project.

Stage 2: Acquaint students with the concepts of instructional design and the process of multimedia design. Students also need to pick a topic in their expertise to design the interactive-learning courseware.

Stage 3: To study hands-on skills, students read the textbook and then follow the demonstration animations created by the instructor. Step-by-step notes are made available to students who prefer to read the printout instructions.

Stage 4: Students turn in assignments that reflect the students' ability to transfer skills and knowledge learned through both the textbook and the learning modules. The students need to communicate with the design buddy and make sure that their design buddy can also complete assignments.

Stage 5: Students complete the interactive learning courseware. The students received a rubric that would ensure their ability to follow the scoring guideline.

The learning procedure in the face-to-face group was very similar to that of the online group. The difference was that the face-to-face group met with the instructor 4 hours a week and could observe the instructor's demonstrations of multimedia skills. Face-to-face group students also were designated design buddies, and they critiqued each other's project in person. I also set up a Blackboard session for face-to-face groups to allow the participants to interact with both me and their design buddies online. In addition to the interaction in the face-to-face classroom, participants received the same feedback and interaction on Blackboard as did the online group.

Data Collection

Data collection occurred within one 14-week semester in the spring of 2005. To investigate participants' understanding of multimedia authoring, I employed multiple methods: dialogue analysis on the discussion forum, email questions, analysis of students' projects, and logs recorded in Blackboard. To measure students' satisfaction with both the instruction and the demonstration animations, I distributed a survey consisting of 16 questions in the final week. I then compared the withdrawal rates and the project-completion rates of these two groups.

Findings and Discussion

Project Completion Rate and Student Withdrawal Rate

The project completion rate of the online participants (88%) is similar to that of the face-to-face participants (87.5%). As for the withdrawal rate, 1 student withdrew from each class; and 1 student in the online course and 2 students in the face-to-face course received incompletes.

Quality of the Projects

Regarding the quality of the projects, 100% of the online participants and 80% of the face-to-face participants met the AECT standards and rubric. Figures 3 and 4 list samples of participants' projects.

Figure 3: Sample project 1

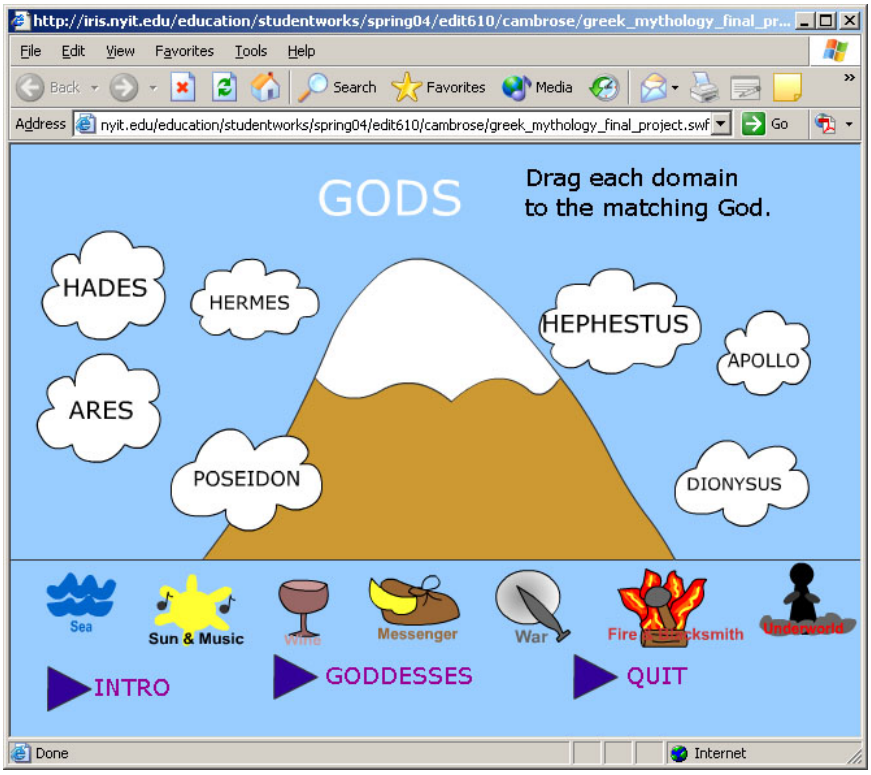
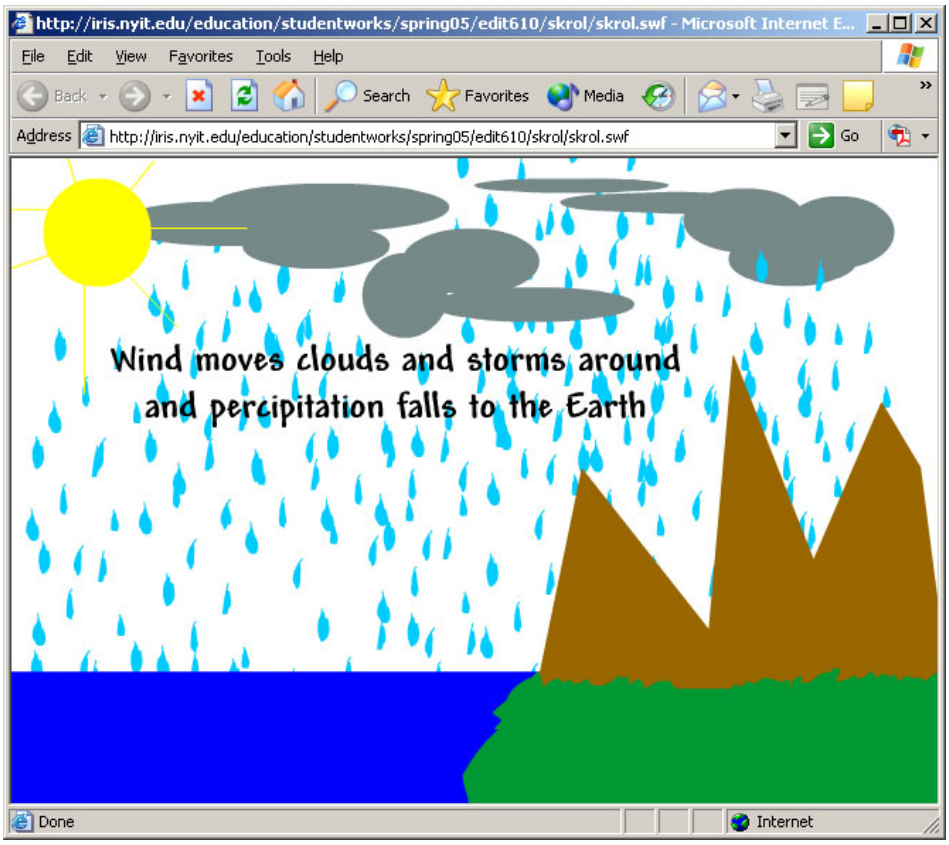


Figure 4: Sample project 2



Survey

Of the 27 participants, 21 returned usable surveys (8 in the online group and 13 in the face-to-face group). The results (Table 1) reveal that 85% of the online participants and that 78% of the face-to-face participants felt satisfied with their projects. And 71% of the online participants and 100% of the face-to-face participants stated that they will apply their own projects to their classrooms. Four participants were implementing their projects in their teaching before the semester's end. The findings suggest that the majority of the participants were satisfied with their projects and that some participants had the confidence to implement their projects in the classrooms.

Table 1. Attitude toward learning hands-on skills online: survey responses

		Online	F2F
Willing to take a course that requires massive hands-on activities in a face-to-face environment as opposed to in an online environment	Disagree or strongly disagree	14.3%	63%
	Neutral	14.3%	28%
	Agree or strongly agree	71%	7%
Rather spend hours commuting to the campus than take a course that requires heavy hands-on online learning	Disagree or strongly disagree	57%	14%
	Neutral	28.6%	21%
	Agree or strongly agree	14.3%	64%
I am proud that my project meets the requirements	Disagree or strongly disagree	0%	7%
	Neutral	0%	7%
	Agree or strongly agree	100%	84%
I feel satisfied with my project	Disagree or strongly disagree	0%	7%
	Neutral	14.3%	14%
	Agree or strongly agree	85%	78%
I will use the project I designed in my classroom	Disagree or strongly disagree	14.3%	0%
	Neutral	14.3%	0%
	Agree or strongly agree	71%	100%
I might take an advanced multimedia authoring course in the future	Disagree or strongly disagree	35%	7%
	Neutral	28.6%	0%
	Agree or strongly agree	42.9%	92%

42.3% of the online participants and 92% of the face-to-face participants stated that they were considering taking any advanced multimedia authoring class that the program might offer. The majority of the students was satisfied with their performance and was willing to learn more in this field. The survey reveals that the majority of online participants (71%) stated that they preferred to take a course requiring the many hands-on activities that are common in a face-to-face course; in contrast, face-to-face participants (62.3%) stated that they were prepared to take an online course in order to save the time of a commute. Although online participants completed their projects on time and fulfilled the requirements, they believed that being able to learn multimedia hands-on skills in a face-to-face environment makes the learning process easier. Face-to-face participants did not have the experience of learning hands-on skills in an online environment and would not understand the difficulties that would confront mastery of hands-on skills without the instructor's or design buddy's immediate feedback. These in-service students had to come to class after their daytime work and believed that they would be able to better manage time by participating in an online class.

Participants in the online group stated that not being able to interact with other students (43%), to interact with the instructor (43%), and to see the hands-on demonstrations in a face-to-face environment (71%) were the aspects of their class that they most disliked. Participants in the face-to-face group stated that the commute to campus was the aspect of their class that they most disliked (61.5%). The online group stated that the streaming demonstration animation was the

most helpful material (71.4%), whereas the face-to-face group chose the hands-on demonstration (53.8%) and the step-by-step notes (30.8%). According to the results, both of the groups believed that being able to observe the demonstrations was the most important aspect in their learning of hands-on skills. According to the results for the face-to-face students, the demonstration animation provided them with opportunities to rehearse hands-on skills because an instructor's demonstrations, whether conducted once or twice, were insufficient. And according to the results for the online group, not being able to physically interact with either classmates or the instructor created learning hurdles because the students desired an immediate discussion concerning the application of newly learned information to their projects. This finding resonates with previous research findings according to which the lack of face-to-face contact is a major barrier for distance education (DeVries & Wheeler, 1996; Hara & Kling, 1999).

Other Data Sources

Although a design buddy had been assigned, one third of the online students did not regularly participate in discussions with their buddies. Online participants pointed out the problem and suggested that the instructor should compel all students to fulfill requirements that students respond to their design buddy's project on time (e.g., provide feedback).

Students used a discussion board to have their instructor and their design buddy examine their ongoing projects, to pose problems they had encountered, and to share knowledge with others who were enrolled in the online course. For communication, the paired design buddies preferred the discussion board to e-mail. In the online group, 8 out of 10 students logged onto Blackboard to interact with other participants at least three times each week and always turned in assignments on time.

Conclusion and Suggestions

General Suggestions for Online Multimedia Authoring Courses

Although the streaming demonstration animation had a positive effect on students' hands-on skills in this study, some factors affected learning outcomes in the online learning environment. Of course, an instructor has to be aware of students' ongoing progress, and in the context of this study, my past experiences as an instructor warned me that once a student fails to turn in assignments on time, it is possible that this student is considering withdrawing from the course. As many researchers claim, "Interactivity is the key to successful online learning" (Mesher, 1999; Smith & Winking-Diaz, 2004). It is easier to build different levels of interactivity in a face-to-face environment than in an online learning environment. In this study, I applied various strategies to the online learning environment in order to increase student-to-student interaction, student-to-instructor interaction, and student-to-content interaction. The project-completion rate and the withdrawal rate in a face-to-face learning environment were similar to the rates for the online group in this study. The quality of the projects completed by the online participants was as good as the quality of the projects completed by the face-to-face participants.

In terms of learning hands-on skills, students stated that the demonstration animation created by Captivate provided a good opportunity for them to observe the instructor's demonstrations. Some quick learners became actively involved in helping others by examining

their projects and by posting suggestions on the discussion board.

Numerous researches have pointed out that the key to a successful online learning environment is the promotion and the maintenance of interactivity (Garrison & Anderson, 2003; Hannafin, Hill, & Land, 1997; Muirhead, 2004). However, these findings and suggestions focus mainly on online courses that require extensive discussion among students. To facilitate an online course that requires extensive hands-on activities, I shall propose several instructional strategies and insights that might promote authentic learning experiences:

1. Provide positive encouragement (Clemons, 2005). Some students are not confident about their artistic expressions or authoring skills, and consequently feel intimidated when asked to submit projects online. It is essential that the multimedia-authoring instructor point out the strengths of each project, provide positive comments, and encourage students to continue the development.
2. Provide consistent and frequent feedback. The success of creating an online community is affected by the frequency of interactions (Stacey & Rice, 2002). The instructor should be available by regularly responding to students' work and questions and by communicating with the students through email.
3. Utilize synchronized tools. A chat room is a good way to strengthen a sense of community in the online learning environment. I recommend that instructors keep virtual office hours and that instructors "stay" in the virtual office so that the students can share comments and thoughts with the instructor or other students in a real-time format.
4. Provide step-by-step notes. The learning module designed by Captivate is insufficient by itself. In this class, I provided step-by-step notes so that students could print out the procedure and select the learning approach that they considered most comfortable.
5. Increase student-student interaction. Encourage students to respond to other students' work. The instructor could assign a design buddy to each student and have the paired students comment on each other's work regularly. Instructors should consider the use of partial grades for student-participation evaluations.
6. Design assignments that require students to apply the skills that they learn from instructional animation to practical contexts. For example, in the "roll-over" button unit, students should study the concepts of designing a button, and then watch the demonstration animation about how to design a roll-over button that displays labels or makes a sound when the users roll over on the button. Then the students should design a roll-over in different contexts and submit the work to the discussion board by the deadline.

Suggestions for Preparation of Streaming Demonstration Animation

To complete preparation of the learning modules efficiently, an instructor can consider the five following suggestions:

1. A microphone is needed to capture audio.
2. Instructors should prepare the narratives and storyboards, and then follow the storyboard to record onscreen actions.
3. Lag occurs when a user records audio while dragging the mouse. It is suggested that users not record audio when either dragging the mouse or performing similar actions on

the screen. These actions can cause a serious lag problem when the animation is played back. Captivate enables the instructor to record voice narratives after he or she has finished recording the actions on the screen.

4. Utilize the highlight box and dialog tools to highlight actions or areas on the screen.
5. Keep backup Captivate files for future revisions.

The output file can be an independent executive file or a streaming Flash movie. Students could use the movie control buttons to repeat the movie over and over again. Captivate also enables instructors to design self-assessment in a short period of time. Instructors can design multiple choice, true-false, match, and Likert-scale types of evaluation, and can decide whether the students have to pass the quiz in order to complete the learning module.

Multimedia authoring is one of the core courses in the field of instructional technology; however, the research of teaching hands-on skills in an online learning environment is scarcely discernable. In this study, I have used action-research techniques to investigate the effectiveness with which technology use supports students' learning of hands-on skills. The findings of this study suggest that instructors' appropriate adoption of onscreen-action-capture technology could have a positive effect on students' hands-on skills in online learning environments, so long as the instructors are aware of related issues, including the importance of both an online community and interactivity among participants. The outcomes hold a pragmatic promise for instructors who face the similar challenge of teaching hands-on skills in an online learning environment. And in line with this promise, the study suggests substantive procedures and plans for the successful application of onscreen-capture technology to a multimedia-authoring curriculum, whether in an online or a face-to-face environment.

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