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ABSTRACT

This paper presents a means of storyboarding in multimedia courseware design that uses Microsoft PowerPoint as a storyboarding tool. In six undergraduate and four graduate teacher-education technology classes, students designed multimedia courseware using HyperStudio/ToolBook with three different storyboarding methods--index cards, paper forms, and PowerPoint. The evaluation scores on four criteria--screen display, interaction possibilities, orientation, and navigation--were compared. Repeated measures were used for data analysis. Differences were found among the groups with different storyboarding methods. It was concluded that, for both undergraduate and graduate teacher education students, using PowerPoint as the storyboarding tool will produce better design in a multimedia application. Screen display, interaction, orientation, and navigation designs were significantly higher using PowerPoint than for the designs using index cards or paper forms. Contains 10 references. (MES)

Different Storyboarding Methods in Multimedia Courseware Design

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Abstract: When we use multimedia-authoring tools, such as *ToolBook*, or *Hyperstudio*, to develop courseware or course segment, we usually go through the major phases of systems development. One of the phases is systems design, in which output, inputs, and navigation are determined and blueprinted, which, technically, are detailed in storyboards. Traditionally, storyboards can be 5 by 7 index cards, or certain paper forms. The current paper will present another means of storyboarding—using *PowerPoint* as a storyboarding tool. The components and procedures of storyboarding will be introduced. In six undergraduate and four graduate teacher-education technology classes, students designed multimedia courseware using *HyperStudio*/*ToolBook* with three different storyboarding methods—index cards, paper forms, and *PowerPoint*. The evaluation scores on four criteria—screen display, interaction possibilities, orientation and navigation—were compared. Repeated measures were used for data analysis. Differences were found among the groups with different storyboarding methods.

Background

Multimedia courseware development is a process of system development (Liu, 1999). Yourdon (1988) and Burch (1992) described a traditional system development life cycle (SDLC) that consisted of seven phases and was widely applied in commercial and industrial fields. The seven phases are: (1) systems planning , (2) systems analysis, (3) General (or conceptual) systems design, (4) systems evaluation and selection, (5) detailed (or functional) system design (6) systems implementation, and (7) systems maintenance. In the field of education, especially for the purpose of developing interactive multimedia instructional applications for classroom teaching/learning, Beasley (1998-99) modified the traditional SDLC into four major phases: (1) systems analysis, (2) systems design, (3) systems implementation, and (4) systems maintenance. In the systems analysis phase, the major problems are identified (Grabowski & Droms, 1994; Henderson, Gold & Tindall, 1996; McDeniel & Liu, 1996), the scope of the system is determined (Burch, 1992; Beasley, 1998-99), and task/concept analysis is performed (Fankhauser & Lopaczuk, 1996; Vrasidas & Harris, 1995). In the system design phase, output layouts are designed for all screens, special forms, and printed reports. All inputs are specified and formats, both screen and paper forms, are also approved. Based on the output and input designs, specific processes are designed to convert the input to outputs (Burch, 1992; Henderson, Gold & Tindall, 1996). According to these designs, detailed tasks of the system are implemented. The system is developed and converted to operation (Burch, 1992). Then the system is maintained until next life cycle.

In developing interactive multimedia application, the designers go through all these phases, and accomplish all designed tasks in all the phases. One task in the system design phase of developing a multimedia application is storyboarding (Ivers & Barron, 1998). There are several methods of creating storyboards, this study examined the effectiveness of three storyboarding methods: using index cards, using paper forms, or using *PowerPoint* to create storyboards.

Storyboarding in Multimedia Courseware Design

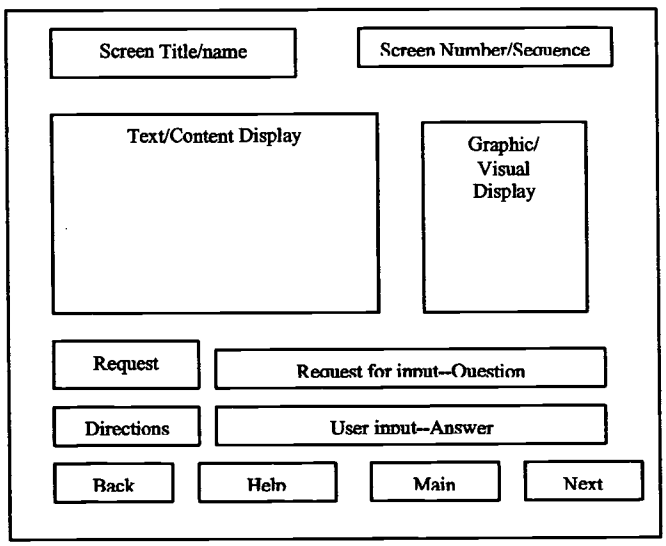
In the system analysis phase, *What To Do* has been determined, and all the requested tasks of the courseware have been listed (Liu, 1999). In the system design phase, *How To Do* will be detailed. For example, screen template and functional areas need to be designed. Multimedia programs, such as *HyperStudio* or *ToolBook*, usually contain at least three screen types: instructional screens, menu screens, and question screens (Ivers & Barron, 1998). The primary functional areas include title, informational/instructional text, graphics, directions,

feedback, icons or navigation options. Screen templates show the exact positions of these functional areas that vary based on the purpose of each screen. The next is to write storyboards.

Storyboards contain all the information that will be placed on the screens (in the screen templates), in addition to information that will assist the programmer and production specialists in development of the media components. Storyboards serve as the blueprint for the program. The detailed storyboards contain all the descriptive information required to produce the text, graphics, animations, audio, and video. Also, the links for each button or interaction are specified.

Traditionally, storyboards are written on 5 by 7 index cards. One card is one screen, all the elements designed for that screen should be on the card. Figure 1 is an example of an index card storyboard before detailed information is put in. In this template, the exact information should be displayed. For example, the screen number, the text content, and questions. The Graphic should be in the right position. The background colors and designs should be specified...

Figure 1. Screen Template Written in an Index Card



Another traditional method of writing storyboards is using some paper forms. This is similar to index card except the size of the paper. In the screen component form/table, all elements are listed and there left the space for detailed explanation. For example, navigation, text and audio can be detailed as:

Figure 2. Paper Form Storyboarding

Navigation:
Button 1:_____ Link to: _____ Action: _____
Button 2: _____ Link to: _____ Action: _____
Text:
Text: Color: _____ Size: _____ Font: _____
Audio:
Source: _____ File: _____ Description: _____

With more and more multimedia applications available for the courseware applications, evidently, neither index-card nor paper-form storyboarding can "tell" all the detailed information to the designer. Therefore, some methods, based on the idea of taking the advantage of technology to solve problems, should be adapted. Considering the format, properties and purposes of storyboarding, we found PowerPoint has the potential to be a useful tool for creating storyboards. PowerPoint slides can contain the same components as in index cards or paper forms, as well as many visual components, such as graphic object, colors, and so on. However, there is no evidence in the literature to show the use of *PowerPoint* as a storyboarding tool. There is no other experience to show either positive or negative of this method. In our technology courses, our students are the designers of multimedia applications. The issues are whether our students could learn multimedia design more effectively with this tool, whether this method

would work well, whether using *PowerPoint* as a storyboarding tool would be better than the traditional storyboarding methods.

Purposes and Research Questions

The purpose of current study was to determine a better storyboarding method among the three methods: index card, paper form, and PowerPoint, so that our students could effectively learn multimedia instructional designs. Considering the different learning experiences, styles, and knowledge background between undergraduate students and graduate students, we examined two research questions in this study:

1. Are there any differences among the evaluation scores of multimedia designs created by undergraduate teacher education students who used different storyboarding methods (index card, paper form, and *PowerPoint*), regarding to the quality of screen design, interaction, orientation, and navigation?
2. Are there any differences between the evaluation scores of multimedia designs created by graduate teacher education students who used different storyboarding methods (index card and *PowerPoint*), regarding to the quality of screen design, interaction, orientation, and navigation?

Methods

Subject and Sampling

This study was undertaken from two dimensions with two groups of students: undergraduate and graduate teacher education students. The subjects were from the College of Education in an eastern state university, including 87 undergraduates from six technology classes, and 72 graduates from four technology classes. The undergraduate classes used *HyperSdudio* to create a multimedia instruction segment, and the graduate classes used *Toolbook* and *HyperStudio*.

Instrument

Instrument used to evaluate students multimedia instructional design was a criteria list consisted of 10 items that have been used in many studies (Ivers & Barron, 1998):

1. Content
2. Language
3. Screen displays
4. Visual images
5. Interactions
6. Orientation
7. Navigation
8. Input, response analysis and feedback
9. Help, evaluation & record keeping
10. Technical consideration

Under each item, there was a detailed checklist. Each quality item was scored from 1 to 10, where the score of 10 was the best. We selected four quality items—screen displays, interactions, orientation and navigation—for the purpose of this study. Because, the quality of storyboarding would directly influence these four design qualities.

Design and Data Analysis

In this study, we used existing classes as the convenient sample. However, in each of the six undergraduate classes, students are randomly assigned into three groups using different methods (Index card, paper forms, and *PowerPoint*); and in each of the four graduate classes, students were randomly assigned into two groups using different methods (Index card and *PowerPoint*). We sorted the undergraduate students' scores of the three groups cross six classes, and the graduate students' scores of the two groups cross the four classes. This was not a completely random design; we only focused on the interested levels of the quality criteria—screen display,

interaction, orientation, and navigation. According the purpose of the study, repeated measures were employed for data analysis. For each group, the four quality criteria were repeatedly measured (see Table 1, and Table 2):

Table 1. Repeated Measures (Undergraduate Groups)

	Screen	Interaction	Orientation	Navigation
Index Card				
Paper Forms				
PowerPoint				

Table 2. Repeated Measures (Graduate Groups)

	Screen	Interaction	Orientation	Navigation
Index Card				
PowerPoint				

SAS system was used for the data analysis, and assumptions for repeated measures were checked. The two sets of data did not violate the assumptions of equal variance, normality, and extreme ourliers. Therefore, we consider that the statistics results of the repeated measures explain the situation of the data well.

Results

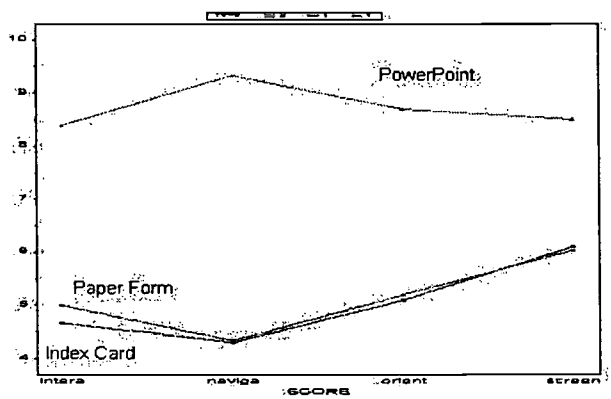
The results of the data analysis shows that significant differences were found among the three groups of undergraduate students' multimedia application design quality scores (see Table 3):

Table 3. Test of Fixed Effects (Undergraduate Groups)

Source	NDF	DDF	Type I F	Pr > F
Method	**2**	**84**	**452.72**	**0.0001**
Score	**3**	**264**	**40.94**	**0.0001**
Method* Score	**6**	**264**	**30.66**	**0.0001**

As shown in Table 3, the differences are significant among the quality scores of multimedia application design created with different storyboarding methods ($F = 452.72$). Figure 3 shows where the differences are:

Figure 3. Interaction Mean Plot (Undergraduate Groups)



As shown in figure 3, quality scores of PowerPoint method group is significantly higher than that of paper forms group ($t = 25.70$, $p < 0.0001$), and that of index card group ($t = 26.41$, $p < 0.0001$). There is no difference between

the paper form group and index card group ($t = 0.71$, $p < 0.4784$). From the mean score plot, we can see the quality scores of the four criteria in PowerPoint group are higher than those in paper form group and index card group.

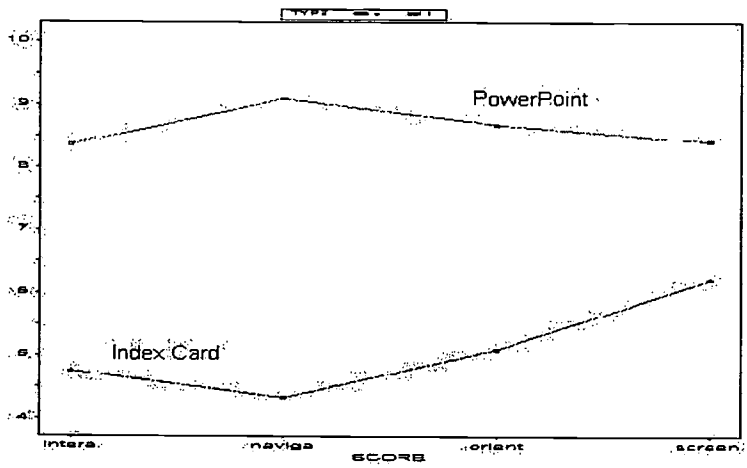
The results of the data analysis shows that significant differences were found among the two groups of graduate students' multimedia application design quality scores (see Table 4):

Table 4. Test of Fixed Effects (Graduate Groups)

Source	NDF	DDF	Type I F	Pr > F
Method	1	70	607.07	0.0001
Score	3	218	22.09	0.0001
Method* Score	3	218	56.65	0.0001

As shown in Table 4, the differences are significant among the quality scores of multimedia application design created with different storyboarding methods ($F = 607.07$). Figure 4 shows where the differences are:

Figure 3. Interaction Mean Plot (Graduate Groups)



As shown in figure 4, quality scores of PowerPoint method group is significantly higher than that of index card group ($t = 24.64$, $p < 0.0001$). From the mean score plot, we can see the quality scores of the four criteria in PowerPoint group are higher than those in index card group. Other detailed results comparing the four criteria will be presented as SITE.

Conclusions and Discussions

In conclusion, as the answers to the two research questions, for both undergraduate and graduate teacher education students, using PowerPoint as the storyboarding tool will produce better design in a multimedia application. The screen display, interaction, orientation, and navigation designs were significantly different (higher scores) from the designs using index card or paper forms in storyboarding. The PowerPoint group showed the high quality of design in the for area: (1) The screen frames were properly designed to achieve balance, harmony and simplicity; color and text styles were used appropriately; and special effects were used properly. (2) Interaction possibilities were maximized and properly designed. (3) A natural sense of dialogue was created with the user; users could control the pace or sequence; screens were properly labeled so users could easily find out where they were—orientation. And (4) Users could easily get where they wanted to go—navigation.

The findings of this study also suggested that although undergraduate and graduate students are different in their learning experience, knowledge background, and thinking skills, the results of the two groups are similar. Figure 3 and 4 showed the same pattern of the differences. This indicated that this method worded well for both groups, and could be used in the technology courses for both groups.

One interesting question was why this method made the differences. When students used index card or paper forms, they only could imagine and put in something that was to be created. However, when using PowerPoint, the storyboarding process is a pre-design process. They could visually arrange the screen, for example, they could put the exact object (buttons, cliparts, or pictures) on the right position. This made the implementation process much easier and they could sense visually. The author of this paper ever conducted a study (Liu, 1999), using a visual tool—*Inspiration*—to structure multimedia application that enabled students to create flowchart that visually showed the structure of the courseware. That study found out it was more effective using *Inspiration* than using paper flowchart in designing the interactions cross several layers of the structure.

The findings from the two studies alerted the idea that technology can be used as a tool not only for improving our daily work but also for developing other technology applications. More and more new technologies are available now. We would not only think about how to use them to solve old problems, but also think how to use them to create new applications.

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