

A Practical Model for Multimedia Development

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Today, technology standards for teachers across the country include multimedia development skills (cf., State Board for Educator Certification, 2006; International Society for Technology in Education, 2006). Multimedia presentations may include text, sound, still images, video, animations, and links to locations within the presentation as well as to documents and Internet sites. Jonassen, (2000) distinguishes between multimedia and hypermedia—the latter referring to the combining of multimedia with hypertext. Hypertext is the non-sequential, nonlinear technique of organizing and displaying text (Jonassen, 2000). While these distinctions hold value both historically and theoretically, this discussion will refer simply to multimedia, for, as Roblyer (2006) suggests, the terms “multimedia” and “hypermedia” are now used interchangeably. When well designed and used appropriately, multimedia can strengthen classroom instruction. It can also engage students in construction of meaningful curriculum-based products.

Discussions about the instructional uses of multimedia are plentiful (Roblyer, 2006; Smaldino, Russell, Heinich, & Molenda, 2005; Jonassen, 2000; Mayer, 2001). However, a limited number of authors offer specific advice on the process of designing and developing multimedia presentations (cf., Misovich, Katrichis, Demers, & Sanders, 2003; Forcier, 1999). My purpose here is to provide a practical process-oriented model for creating effective instructional multimedia presentations. The model, which has been used successfully by preservice teachers in a graduate course in multimedia

production, was adapted from a model used at an instructional development center at Florida State University for purposes of developing multimedia projects. The model requires the developer to produce a series of design documents which provide building blocks leading to completion of a multimedia project.

Perspectives on Planning Multimedia Projects

Some authors provide useful guidance to would be multimedia developers. Jonassen (2000) offers Lehrer's (1993) framework which consists of four phases: planning; developing knowledge of the content; evaluating the knowledge base; and revising the knowledge base in light of feedback. For Jonassen, multimedia presentations stand as a type of mindtool—a knowledge construction tool.

As Jonassen explains, planning requires the multimedia author to determine instructional goals, identify the audience, determine relationships among topics, specify interface design, and decide upon strategies for collaborating with others. Developing knowledge of the content entails finding and collecting relevant information, picking and interpreting sources of information, generating new interpretations, determining the medium by which knowledge components will be represented, and specifying what types of links will be used to facilitate connections among the content. Evaluating the knowledge base involves an assessing how the information is displayed and organized, assessing the adequacy and organization of provided information, testing the actual multimedia project, and conducting a formative evaluation with target group members and obtaining their feedback. Finally, the developer uses the feedback to revise the knowledge base. This includes correcting errors in the content and possibly restructuring the knowledge base to increase accessibility and meaningfulness. Lehrer's work is useful, especially in light of Jonassen's interpretation of it as a framework for using multimedia projects as mechanisms for knowledge construction.

Roblyer (2006) also offers useful, specific advice on how to author multimedia materials. Her advice centers upon six distinct steps: reviewing others' products, doing research, storyboarding, developing frames and segments, adding links or scripts, and testing and revising the project. Roblyer aptly notes that multimedia developers proceed through two distinct phases: the first concerns learning the mechanics of authoring programs (e.g., PowerPoint, HyperStudio, or other) and “. . . understanding the concept of hypermedia” (p. 186), while the second concerns the long-term process of

developing insights about the complexities of utilized media and knowledge of visual design principles (cf., Kemp & Smellie, 1994; Smaldino et al, 2005) and navigational mechanisms (Semrau & Lu, 1992). Roblyer (2006) suggests that fledgling developers start by reviewing existing projects, including commercially-produced ones. Next, lays the heart of the process—doing research. This involves finding topically-related materials and information, then analyzing and summarizing them. Next comes storyboarding—that is, drawing out what is to be depicted in each frame of the presentation. Developing individual frames requires that the developer produce individual displays using appropriate software. Subsequently, the developer is to add links for moving among displays, audio components, and transitional effects. Finally, the developer should test the presentation to determine how it should be revised. Major areas of concern while testing include the quality of content, instructional design integrity, organization and navigation, aesthetics, and graphics, video, and sound. Roblyer’s advice is clearly on target, providing useful guidance to inexperienced developers wishing to enter the multimedia development arena.

Multimedia Design Principles

Mayer (2001) offers related, research-based principles for multimedia design. His research provides evidence that applying the following principles promote learning:

- multimedia principle: learning is stronger with words and pictures than with words alone
- spatial contiguity: presenting corresponding words and pictures in close proximity produces better learning than placing them far from each other
- temporal contiguity principle: presenting corresponding words and pictures simultaneously results in better learning than presenting them successively
- coherence principle: excluding extraneous words and pictures produces better learning than including them
- modality principle: animation with narration produces better learning than animation with accompanying text
- redundancy principle: excluding text when presenting animation with narration produces better learning than including the text
- individual differences principle: effects of the above principles are stronger for low- knowledge and high-spatial learners than for high-knowledge, low-spatial learners

Mayer (2001) suggests that "The characteristics that a learner brings to the learning situation influence the effectiveness of implementing multimedia design principles" (p. 179). He argues that learners who possess a low amount of prior knowledge about the topic at hand will benefit more from the application of the principles than those who have greater levels of prior knowledge. Further, as Mayer explains it, learners who are good at generating, maintaining, and manipulating visual images are likely to benefit more from using well designed multimedia materials than are learners who are poor at these activities-- that is, learners characterized as having low spatial ability.

Others such as Semrau and Lu (1992) also offer advice on effective design principles for multimedia materials. These authors suggest that well designed multimedia materials should reflect application of the following guidelines:

- maintain consistency as to how the user interacts with the multimedia material
- place navigational buttons in consistent locations
- maintain consistency of screen design and layout
- maximize user navigational control (e.g., provide forward and backward control)
- provide graphic cues such as color schemes so users know their location within the material
- provide consistent access to the main menu
- present information in small chunks
- provide for feedback and remediation
- maintain the user's interest by using an appropriate readability level and an informal conversational style
- maximize interactivity by integrating content-related problems and questions

The authors also suggest providing users with clear instructional objectives, a variety of positive feedback, and regular opportunities for evaluation of learning.

A Practical Model for Multimedia Development

The model offered here is unique in that it is driven by the development of specific design documents, all of which lead to the production of an instructional multimedia product. It is an adaptation of a traditional instructional systems development model, modified for use with multimedia projects. The practicality of the model—which has

been applied in both professional and teacher education settings—has been demonstrated in practice. With its emphasis on tangible design and developmental documents, the model lends itself to iterative, team-based and collaborative approaches to multimedia development. It is best suited to development of individualized, not instructor-led, instruction.

Developing a Need Statement

When applying the model, the first step is to develop a needs statement. Because of the time constraints inherent in delivering a typical graduate course, this is done in lieu of a formal needs assessment. In this step, the multimedia author should first review one or more relevant curriculum frameworks to identify an appropriate instructional topic. Once a potential topic has been identified, the developer should research extant multimedia materials on the selected topic. If appropriate commercially produced or student developed materials exist, the developer should probably choose a new topic. If not, the developer can choose to pursue the project.

The Model

Analyze

- Identify audience, need, and goal as drawn from an existing curriculum standard.
- Check for similar, existing programs.
- Decide if project should be developed.

Design

- Develop needs statement and objectives. (review & revise) (r & r)
- Develop treatment (r & r)
- Development
- Develop content document (r & r)
- Develop usage plan (r & r)
- Develop sample storyboards; OPTIONAL (r & r).
- Develop flow diagram (r & r)
- Develop support materials (r & r)

- Develop evaluation plan and instruments (r & r)
- Produce program. - storyboards - flow diagram - support materials - evaluation plan and instruments - prototype program

Implementation

- Arrange for students to use program as planned.

Evaluation

- Develop evaluation plan.
- Gather evaluative data as students use the program.
- Measure learning.
- Assess learners' attitudes toward instruction.
- Analyze evaluative data.
- Revise instructional strategy, program, and support material as required.

Developing a need statement enables the developer to specify both an instructional goal and the intended learners. Based upon the curricular goals and audience, the developer also generates specific learning objectives. The developer addresses all of these issues in the need statement which serves to focus the overall purpose of the project. The instructor and peers should then review the needs statement and offer suggestions for improvements, leading to the author revising the document.

Developing Content: Once the needs statement is finalized, the next step is to develop the content for the project. This step is highly consistent with previously discussed advice offered by other authors. Content is the information the multimedia author needs to have in hand in order to develop the project. It is the information attached to objectives that will be provided to the students interacting with the project.

Content can take many forms depending upon the nature of the objectives. Some likely forms of content--drawn from actual student projects-- include the following:

- Definitions: For instance, what is the definition of democracy?
- Illustrations of concepts with examples and non-examples: What are the critical characteristics of an estuary? How does an estuary differ from a river?
- Statements of cause and effect relationships (principles): Why does water evaporate?

- Descriptive narrative: What happened during the first 20 years of George Washington's life?
- Chronological narrative: What major events led to the advent of World War II or the Iraqi war?
- Timelines: In what sequence did major events occur leading to the revolutionary war and the establishment of the United States?
- Step-by-step procedures: What are the steps for conducting an experiment?

Other types of content may be appropriate depending on the nature of the learning objectives. The developer may choose to write content in a direct, user-friendly fashion so that it can be imported directly into the project. In a multimedia development course, the instructor should review the content and provide constructive feedback. A common problem with first drafts of content is that they lack specifics or are not adequately developed.

Developing the Treatment: The treatment is a narrative describing what the multimedia user will see, hear, and do. The treatment explains how the student will interact with the program and how it will be organized. It includes references to content and describes where and how questions and feedback will be provided. Following are some guidelines for developing a sound treatment:

- the writer should indicate the overall organization of the project, noting the number and focus of the separate "stacks" or files to be incorporated;
- the author should explain how the project will be organized in terms of topics and subtopics to be covered;
- the writer should explain how the student is to navigate through the material and describe use of menus and sub-menus;
- the developer should discuss use of pictures, clip art, animations, sounds, and video clips;
- the author should explain what instructional methods the project will feature (see Smaldino et al., 2005);
- the developer should provide useful but not excessive details about the structure and appearance of the project (for instance, one can allude to screen colors if they're important or such details can be worked out later);
- the writer should address how students will be questioned to monitor understanding and comprehension and how feedback will be provided.

The instructor and peers should next review the draft treatments of others. Each author can then revise the treatment based upon feedback.

Developing a Usage Plan: Developers need to understand that a multimedia project need not be a stand-alone piece of instruction. Rather, a given project can be conceived of as part of a larger overall sequence of instruction. In this light, possibilities for project use are greatly expanded. The project may serve in a pre-instructional, instructional, or post-instructional role.

Essentially, there are three usage modes for teacher-made instructional multimedia materials:

- use by individual student (individualized approach)
- use by small group of students (small group approach)
- teacher presents to large group (teacher-led presentation)

Of course, having students construct their own multimedia projects is a desirable alternative strategy.

In terms of the timing of instruction, multimedia materials can also be used in one of three primary ways: before instruction, as instruction, or after instruction.

When used as pre-instruction, a project may serve the following purposes:

- gaining students' attention
- sparking students' interest and motivation to learn
- helping students review essential prerequisite material

If the intention is for the materials to carry the weight of instruction, some related considerations include the following:

- multimedia lends itself to development of intellectual skills
- multimedia allows for independent, open-ended study
- multimedia should maximize teaching capabilities of the computer and software

With post-instructional uses, the developer should keep the following in mind:

- multimedia can be used for student remediation
- the project can be used to review material or provide spaced practice (review at a later point in time after initial lesson delivery)

When used as a post-instruction review, a drill and practice method may be quite appropriate. Another idea is to design and use a project to support students in transferring previous learning to new contexts and more advanced problems.

The usage plan itself is a document which explains what basic usage mode will apply. It also describes what basic instructional use will apply. The author should fully explain related reasoning and provide rationales. Experience has shown that many students state that a given project can be used in all three usage modes and in all instructional modes. It is preferable if the student can take a stand regarding usage and instructional modes, one way or another.

Developing an Evaluation and Learning Assessment Plan: When contemplating the design of an evaluation and assessment plan, the designer should decide what is to be determined as a result of the evaluation. This type of evaluation typically centers on learner reactions to the multimedia material. Common key evaluation questions include the following:

- Did learners enjoy the instruction?
- Did learners feel the instruction helped them learn, and meet the objectives?
- What ideas do learners have for revision of the instruction?

The evaluation plan should also specify how data will be gathered. Possibilities include focus groups, individual interviews, and questionnaire. A formal test may also be included in the plan.

Closing Comments

The provided model has been successfully applied in graduate courses and in a university instructional development center. It consolidates many processes that various authors suggest are required to design and develop effective multimedia materials for instruction. The model's strengths include its clear process-driven approach and the resulting enroute design documents which can readily be reviewed and revised. Such an iterative, empirical approach is consistent with established instructional design principles which, when applied, improve the likelihood that

instruction will be effective. The author welcomes further discussion and suggestions regarding use of the model and the design process it prescribes.

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