INTERACTIVE **MULTIMEDIA DESIGN** AND PRODUCTION PROCESSES

Abstract

The purpose of this study was to provide information on the **multimedia design** and development process used by the practitioners in the field. It sought to inform students who wish to pursue a career in **multimedia** of the skills and knowledge needed and instructors who teach **multimedia** related courses of the process employed by practitioners so as to help better prepare students for the job market.Extensive interviews were conducted with the experienced **multimedia** developers wb0 assumed various roles and were involved in developing **multimedia** educational materials. The findings of the study were presented through the following aspects: (1) bow the**multimedia** production process works, (2) the roles and responsibilities of people who work in the field, (3) the factors contributing to successful **multimedia** development, (4) tips and techniques in **multimedia** development tiered by practitioners, and (5) the popular hardware and software used. Implications of the findings and suggestions for how students should prepare themselves to enter the**multimedia** field were also discussed. (Keywords: instructional **design**, interactive **multimedia**, **multimedia** practitioners, production process, techniques.)

Imagine these two situations:

Upon graduation, a student majoring in instructional technology accepts a job as an instructional designer for a **multimedia** company. Yet she finds herself ill-prepared for the job because what she learned in the classroom reflects little of what is actually used in the **multimedia**field.

A professor is asked to teach courses on **multimedia** development and finds that the literature on instructional **design** provides little insight into the actual **design** and production process used by **multimedia** professionals.

Interactive **multimedia** is becoming increasingly popular in education, entertainment, and business. Because of the capabilities of incorporating various media and of supporting interactivity and learner control, **multimedia** is often used in delivering instruction (Nielson, 1995). Research has shown that interactive **multimedia** technology has potential for enhancing learning (Burton, Moore, & Thomas, 1995; Nelson, 1994; Nelson & Palumbo, 1992). Furthermore, the World Wide Web technology with its interactive **multimedia** capability has been perceived to be one of the most promising technologies in the future.

Although there is a general consensus among educators that interactive **multimedia** has the potential to enhance learning, educators also agree that having well-designed**multimedia** software is critical for the technology to have any impact on learning. With the growing need for more quality **multimedia** software, there is a strong demand for **multimedia** professionals. A number of large publishing companies have made the development of **multimedia** curricula materials their new focus. Many **multimedia**development companies have been formed during the past five years. In fact, the market for **multimedia** development is one of the fastest growing industries according to a recent survey (Schmit, 1996). The excitement of the field is attracting college students to enter this profession. Many are looking for jobs to develop **multimedia**programs. But, what do we know about the **multimedia design** and production process? What steps are involved in designing **multimedia** programs, and what factors can contribute to successful **multimedia** development? Are our students prepared to become successful professionals in **multimedia** development?

Although college students may gain a solid foundation in theories, what is taught in a traditional classroom often bears little resemblance to what is needed in today's job market. Students often lack the competence in professional practice that requires the practical knowledge and insight gained through practice (Gentry, 1994; Harris, 1993; McCormack, 1984; Quinn, 1994). There is a need for more integration of academic knowledge and practical experience (Quinn). Such a need is more obvious for those who teach and learn in the field of interactive **multimedia** technology because of the rapid changes in this field.

Multimedia development involves the process of creating a "software program or document containing media such as text, audio, video, animation, and graphics combined or hypedinked and presented in a nonlinear and interactive mode for the purpose of exploring one or more ideas" (Fox, p. 38). It is the process by which management,**design**, and development are integrated to create instruction allowing "students to explore, discuss, evaluate, and articulate their knowledge" (Fox, 1995, p. 39) and to build on their prior knowledge of the content area. Although there is abundant literature on how to use certain software and hardware, little is found on how the**multimedia design** and production process works.

Literature on instructional **design** has detailed the process for developing instruction in general terms. There are numerous instructional **design** models and approaches (Dick & Care}51996; Gentry, 1994; Greer, 1992; Merrill 1988; Reigeluth, 1983; Wager & Gagne, 1988; West, Farmer, & Wolff, 1991). Whether they are behavioristic or cognitive, linear or nonlinear, these models and approaches emphasize the importance of identifying objectives, selecting appropriate strategies, and conducting formative and summative evaluations. However, these models and approaches do not provide concrete procedures to carry out the **design** of computer-based courseware (Yang, Moore, & Burton, 1995): "What has been learned from those ID [instructional-**design**] models becomes inert when the designer actually faces the challenge of developing a courseware unit" (p. 60).

Incorporating software engineering principles, Yang and his colleagues (Yang, Moore, & Burton, 1995) proposed an instructional **design** model for producing compurer-based instruction consisting of three stages: analysis, development, and evaluat-ion. They attempted to specify different activities and responsibilities of different roles involved in developing courseware. Other literature has also described instructional **design** principles for computer-based instruction (Jonassen, 1988; Overbaugh, 1994).However, much of this literature is theoretical. Few guidelines have been developed in response to the more recent interactive **multimedia** technology The application of an instructional **design** model is often context sensitive (Yang, Moore, & Burton). Do these instructional models and approaches apply to **multimedia** development? To what extent do these models reflect real world **multimedia** practice? What are some of the **design** characteristics unique to **multimedia** development that instructional**design** models should reflect?. There is clearly a need to look at what the **multimedia** practitioners do in their everyday work and understand the process they use. Such practical knowledge can help contribute to our understanding of the instructional **design** process for **multimedia** development and inform the meaningful applications of the instructional **design** models in an appropriate development context. Such practical knowledge also forms the basis of new theories and models.

In an attempt to provide some useful and practical information about the **multimedia** development process, we conducted a study on how practitioners **design** and produce **multimedia** programs. Our purpose is twofold: first, to inform students who wish to pursue a career in **multimedia** of skills and knowledge needed, and second, to inform instructors who teach **multimedia** related courses of the process employed by the practitioners so that they are able to better prepare their students for the job market. **Multimedia** development encompasses many different aspects. This study focuses on the **design** and production aspects of **multimedia** development.

RESEARCH QUESTIONS
Our research questions were:
1. How does the **multimedia** production process work?
2. What are some of the factors in **multimedia** development that are critical to the quality of the programs?

3. What different roles do people play in **multimedia** development and how do these roles interrelate?
4. What can students interested in **multimedia** do to prepare themselves for the job market?

METHOD

To answer the research questions proposed, we interviewed **multimedia** practitioners involved in developing **multimedia** programs in Austin, Texas. Major technology companies such as Apple, Dell, IBM, MCC, Motorola, Samsung, and Texas Instruments, as well as many smaller technology companies, are located in Austin. Austin has a very active **multimedia** community that supports both award-winning and start-up companies. According to a recent article (Schmit, 1996), Austin is one of the top six cities that supply **multimedia**-related jobs.

Subjects and Procedure

Using the 1995 **multimedia** directory compiled by the Texas Governor's Office of Music, Film, Television, and **Multimedia** Industries, we identified a list of **multimedia**companies in the Austin area. Our goal was to understand the process for developing instructional materials. Therefore, we chose to interview only those companies involved in producing educational **multimedia** tides, rather than pure entertainment programs. From the **multimedia** directory, 18 companies that have a reputation for producing quality educational **multimedia** materials were identified. To ensure the credibility of the interviewees, we excluded one-person shops. We contacted all of these companies and were able to interview 16 developers from 10 multimedia companies that met our interview criteria and were available. (A developer is someone who assumes a specific role in the **multimedia** process.) These interviews ranged from 15 min. to i hr. and 15 min., depending on the available schedules of the interviewees, with an average of 45 min.

This research project was conducted during the summer and fall of 1996. All 16 interviewees were working on instructional and interactive **multimedia** projects at the time of their interviews. A number of the interviewees had contributed to award-winning **multimedia** titles. Eight were female and eight were male. The developers came from various backgrounds such as audio and video production, film, television, computer science, art, graphic **design**, history, physics, and instructional technology. Some had bachelor's degrees, while others had masters degrees. All of the interviewees had years of experience in designing and developing mukimedia products and assumed different roles in their companies, such as project manager, instructional designer, programmer, graphic artist, animator, permission specialist, and videographer. It was our intention to interview developers with different responsibilities in order to have a more thorough understanding of the mukimedia process. With their experiences and backgrounds, these **multimedia** developers were able to discuss the process of developing **multimedia** projects from several perspectives: (1) as overseer of the entire process, such as a project manager; (2) as department head, such as a lead instructional designer, or an art director; and (3) as developer with a specific role, such as a permission specialist, an instructional designer, or a graphic artist. In addition, some interviewees were owners of businesses, while others were employees of a company.Collectively, these interviewees were able to discuss the **multimedia** process from a wide variety of perspectives.

Development of the Interview Questions

Four research questions formed the focus of our inquiry. Using these research questions as the starting point, we proceeded to develop a series of interview questions.The development of the interview questions was based upon the synthesis of the few published materials on the topic (Apple Computer, 1994; Gayeski, 1995; Josephson & Gorman, 1996). Initially, questions on various aspects of **multimedia** were developed, including questions on fact checking, project management, authoring, programming, and graphics. Using these quest tions, three preliminary interviews were conducted with **multimedia** developers who assumed three different roles in a mediums-size company. The purpose of conducting the preliminary interviews was to confirm the importance and appropriateness of the interview questions and to ensure that the questions developed would answer the four research

questions. Based on the data gathered from the preliminary interviews, the interview questions were revised and refined. A number of questions were added, some were dropped, and others were rephrased. The final interview questions, a total of 182, were put into 12 categories, roughly correlating with 12 aspects of the **multimedia** production process:

1. general questions specifically addressing the overall process employed at the company, the division of roles, important aspects, and tips for producing **multimedia**;
2. fact checker questions;
3. author questions;
4. permission specialist questions;
5. project manager questions;
6. programmer questions;
7. artist questions;
8. animator questions;
9. instructional designer questions;
10. writer/editor questions;
11. videographer questions; and
12. audiographer questions.

The number of questions within each category ranged from 3 to 29. Sample questions included the following:

- What is the role of your department in the **multimedia** process?
- What kind of expertise do you look for in hiring new people for your department?
- What are some of the major obstacles you face in doing your job?
- How do you coordinate with instructional designers?
- How do you acquire contracts?
- In what way do you utilize user-testing?
- How much of the screen do you reserve for text?
- When is voice-over utilized over text?
- Who is responsible for the script and storyboard of the video?
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(All interview questions are included in the Appendix.) In addition, each interviewee was asked to describe his or her professional and educational background and personal insight into the **multimedia** profession.

Data Analysis

The interview data were first transcribed, then chunked, coded, and categorized following Miles and Huberman's guidelines (1994). A three-level scheme was used. At the first level, codes were generated directly from the data through multiple passes of data examination among the three researchers involved in the data analysis. At the second level codes generated directly from the data were regrouped into more general categories. During this process, the codes were refined and revised, and new codes for emerging themes were added. Patterns were extracted from the data and the relationships between the coded segments were compared and contrasted. The data were then sorted into categories and subcategories according to their common themes and shared relationships. Finally, using the research questions as a guide, the codes along with their themes were nested in the seven general categories as determined by the research questions. Each of the three researchers independently coded the data first. Then the researchers compared and refined their codes. Disagreements among the researchers were discussed and resolved after reexamination of the data until a .98 interrarer reliability for all the data was achieved.

RESULTS AND DISCUSSION

Based upon the analysis and synthesis of the interview data, we will present and discuss the findings in the following categories: (1) **multimedia** development process, (2) roles and responsibilities, (3) factors contributing to successful **multimedia** development, (4) some characteristics of **multimedia** development, (5) tips and techniques in**multimedia** development, (6) hardware and software used, and (7) suggestions on how to prepare for a career in **multimedia**.

Multimedia Development Process

The interview data revealed that the **multimedia** development process, although it varies from company to company consists of six main phases: (1) funding, (2) planning, (3) designing, (4) producing, (5) testing, and (6) marketing (see Figure 1). Each phase has a number of activities associated with it and has its own characteristics. These phases represent the process from the inception of an idea to the finished product. Companies very often work on several projects simultaneously.The projects are at different phases for predetermined periods of time. Funding. Obtaining funding is a critical phase for most **multimedia** companies. According to these interviewees, there are a number of ways they get funding (1) writing proposals to get a grant from public or private sources; (2) responding to "Request for Proposals" (RFP); (3)joining competitions; (4) obtaining contracts through personal contacts, referrals, or both; and (5) creating a prototype and then finding a company interested in developing it. For the companies interviewed, most of their work is through a contract with a client obtained by one or more of these means. The client can be a major publisher, a state or federal agency, or a company. The project managers, executive producers, or owners often spend a considerable amount of time writing proposals to respond to RFPs and networking with other interested parties. A study by McDaniel and Liu (1996) has detailed characteristics and evaluation criteria for writing proposals to get a grant from a funding agency and for submitting a competitive bid in response to a RFP. Their findings were well supported by the data from this study. A well-written proposal not only presents a match between the goal of a funding source and the developer, but also outlines a detailed plan and demonstrates a proven track record. In addition, the interviewees pointed out a number of important factors that could contribute to successful funding. Small businesses often engage in publicizing their capabilities to promote their business. If a business finds a need for a particular product, it should take the initiative to contact relevant companies, museums, or agencies to promote their ideas and get potential clients interested. "You need to get the word out," one interviewee pointed out. One interviewee commented on the importance of "knowing people in the business and letting them know that you are interested if a project comes up." Producing quality work helps establish a reputation so that the client may return in the future. As is the case for several of the companies that participated in the study, it is certainly advantageous when the product wins an award.

Planning. Once a contract is secured, a series of negotiations begins between the developer and the client. These experienced developers mentioned that it was very important to discuss the ownership of the content, the project schedule, and payment during the negotiation phase. The negotiation phase dearly defines the roles of a client and a developer from initial contact (Quinn, 1994). Sometimes, the developer will receive the content from the client who owns the copyright of the materials and other times the developer has to generate new materials from scratch. The developer and the client need to agree on the completion dates or milestones for various phases to ensure the feasibility of the intended amount of work. The budget is discussed at this point. The ultimate goal of a contract is to help maintain a favorable working relationship between client and developer and to agree on roles and division of responsibilities (Strauss, 1995). Based on what the client wants, the development team begins to brainstorm, outline the objectives, and decide on the presentation style, the delivery platform, and the approach to turn the content into an interactive**multimedia** product. Often, these ideas are implemented in a prototype which is reviewed by the client to see if it satisfies its needs (see Figure 1).
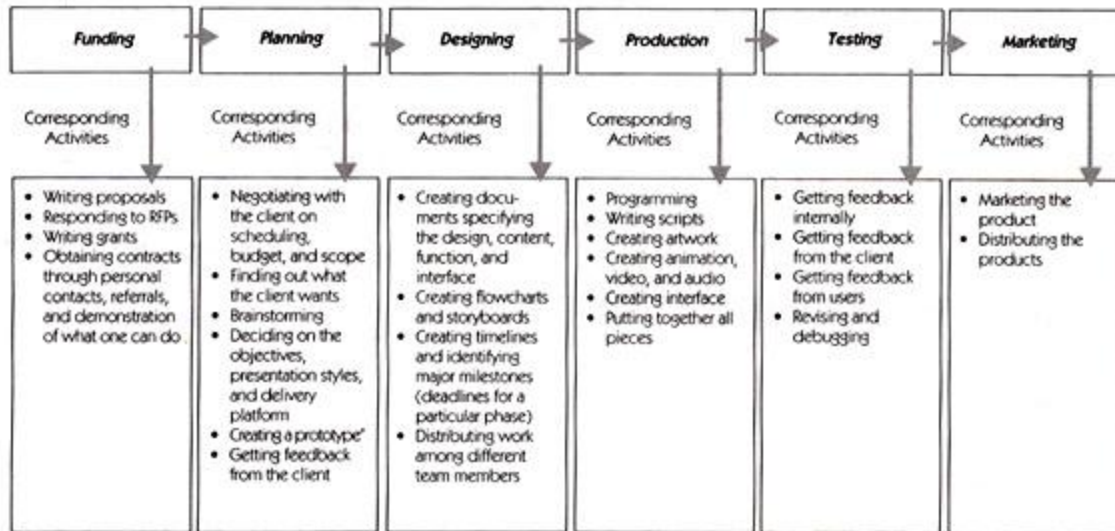
*Figure 1. Major phases of **multimedia** development as explained by practitioners*

Designing. Based on the client's feedback of the prototype, various specification documents are developed that provide detailed information on content, **design**, interface, and functions of the product. During the **design** phase, the objectives, presentation style, delivery platform, and overall approach are finalize& Details such as the **design** of each screen, the type of navigation to be used, and the interactive characteristics of the interface are worked out. Terms such as **design** document, functional specifications, and content script are used by the interviewees to refer to different specification documents depending on the information and format provided by the document. Flowcharts and storyboards are created to reflect these specifications. Detailed timelines are created and major milestones are established for the critical phases of the project (see Figure 1).The work is then distributed among various roles such as designers, programmers, graphic artists, animators, videographers, audiographers, and permission specialists.

Producing. The production phase follows. Instructional designers, graphic artists, animators, videographers, audiographers, and permission specialists begin to develop scripts, artwork, animation, video, audio, and interface. Programmers begin to generate codes to put all the pieces together (see Figure 1). The production phase will run smoothly if the project manager has carefully selected the team members, distributed responsibilities, and created realistic milestones in the production schedule. Group discussions are more common and frequent during the planning and designing phases, whereas, in the production phase, team members will focus on their production tasks and meet only with the lead instructional designer and project manager to evaluate what has been created.

Testing. Unlike some traditional instructional **design** models in which evaluation occurs at the end of the process, the interviewees emphasized that testing was continuous and repetitive. Formative evaluation occurs at every phase and multiple times (see Figure 1). Many interviewees stress the importance of having such continuous evaluation as a key factor for ensuring the quality of the product. Evaluation takes on different forms. Some forms used by the developers include informal critiquing by members within and across the teams within the company, ongoing evaluation by the clients, and using focus groups and surveys to get feedback from the end users. Depending on the nature of the product and the type of audience, different forms are used. "It is just invaluable to get feedback,' a project manager commented. For most of the developers interviewed, constant evaluation within the company and with the client occurs more often than with the end users. In addition, the companies use a four-step evaluation as the major milestones for quality assurance: prototype, beta, alpha, and final testing. The data revealed that some clients tend to hire developers who know how to test for instructional value and who tend to build testing into their

budget in response to a RFP. The finding supports the literature, which reveals that
because **multimedia** development is a complex process involving many skills and people, ongoing evaluation and revision are critical to ensure the success of the product (Apple Computer, 1994; McDaniel & Liu, 1996). Although multiple cycles of formative evaluation were used, the interviewees also mentioned that summatire evaluation seldom occurred. Lack of funding and lack of control over the product once delivered to the dient were reasons given for an absence of summative evaluation.

Marketing. Marketing and support are important to the success of a product. The survival of a company depends on the product reaching the audience. The elements of marketing include researching the industry, the audience, and the competition. Marketing also indudes the responsibility for determining the price and coordinating the advertising and public relations for the product. Practices for marketing and distributing the products vary from company to company.

Most companies interviewed, however, are not concerned with marketing because they were hired to develop a product by their clients. When the product is completed, they deliver the product to their clients, who are responsible for marketing and distributing the products. In such cases, the need for such a product is presumably established by the clients and the distribution channels for the product have been determined.

Roles and Responsibilities
"Different tides will require different mixes of skills at different stages in each project to achieve effective implementation" (Hudson, 1995, p.46). Developing a **multimedia** product calls for creative work from many different people such as a project manager, an instructional designer, an author/programmer, an artist, an animator, a writer, a videographer, an audiographer, a subject-matter expert, and a permission specialist. The degree to which these different roles collaborate has much to do with the success of a finished product. As the technology has evolved, these roles within **multimedia** companies and their corresponding responsibilities have been developed accordingly. Depending on the size of the company, one person might play more than one role or the roles might be expanded into departments.

Throughout the creation of a **multimedia** project, the people responsible for each of the roles within the company must be in constant communication to ensure consistency in the **design** and focus of the end product. The interview data showed that the project manager had the primary responsibility of negotiating with the client and outlining the objectives, scope, schedule, and funding for the project. He or she coordinates the efforts of other roles and ensures that all people involved in the project stay on task and complete their part by the specified deadline. A project manager, therefore, must not only be openminded, but also be very efficient and effective. During the planning phase, the different roles often provide their input into the vision of the project. Their input helps ensure that all team members have ownership in the vision and are motivated toward common goals. Expertise from the different players is vital in determining whether certain **design** elements are feasible within the guidelines of the project. Instructional designers often assist the project manager in identifying clients' needs and establishing instructional objectives for the project. Once the client and project manager agree on the content and scope of the project, the instructional designers (in collaboration with the subject matter experts) outline the details of the content and **design** of the final product. They select appropriate strategies and media for delivering the content, devise test items, and then create storyboards or **design** specifications for communication during development of the project. Another important duty of an instructional designer is to compare what was created with the clients needs and outlined objectives. In short, it is the task of instructional designers and the project manager to provide the blueprint for a project and the blueprint is then executed by other team members, such as programmers and artists.

All roles are involved in the production phase: the artist creates graphics; the programmer writes codes; the animator **designs** the animation; the writer writes scripts; the videographer collects and digitizes video; the

audiographer casts, creates, or purchases sound; the subject-matter expert checks the content validity; and the permission specialist searches and obtains copyrights. An important characteristic of all these roles is that they not only need to have a solid background in their respective fields, but also should be able to pick up new skills quickly for their new environment. The interview results suggest that the production phase is both creative and tedious, involving constant revisions. One audiographer believed that it took more development time for those developing audio and video because audio and video are time-based media:"When you finished creating a picture you can go home. But when you are doing audio, you have to listen to it and tweak it, listen to it again and tweak it" and so on.Regardless of the roles and tasks, the interviews revealed that actual production time often exceeds one's expectation and team members often spend long hours to meet the approaching deadlines.

Instructional designers are also involved in production. They often supervise and sometimes participate in such tasks as writing scripts, selecting audio and video sources, and testing. The results showed that for many smaller companies, a project manager was sometimes also an instructional designer or an instructional designer was sometimes also a programmer. In other words, "we all wear different hats at different times." To running an efficient smaller company; employees must be flexible and have multiple talents. A number of developers emphasized the advantage of working in a small company because it was more able to respond and adapt to the rapid changes of **multimedia** technology and the demand of the market.

As the production phase progressed, the programmers begin to stitch together the elements of the project. When the production phase comes to a close, many of the team members remain on the project in order to revise the project based on client feedback, evaluations, alpha testing, and beta testing. After the production phase, the project managers continued to oversee the project, communicate with the client, complete the project, and deliver the product to the client. Table i lists the detailed responsibilities and characteristics of some key roles in **multimedia** development.

Factors Contributing to Successful **Multimedia** Development
According to all interviewees, several factors contribute to the success of a **multimedia** project. These factors are: (1) maintaining constant and clear communication among all people involved in the process, (2) taking advantage of the individual developer's talents, (3) using continuous evaluation and feedback, and (4) keeping on task and on schedule. Because **multimedia** development involves many different roles, communication among all parties involved is important. They must have a "commitment and a shared desire...to learn from each other" (Hudson, 1995). Most interviewees mentioned that they conducted weekly team meetings and held regular informal conversations. Such constant communication among team members helps keep everyone on track and prevents problems early on. Most of the interviewed companies used brainstorming to get creative ideas from all involved in the project. One project manager said, "We try to get everyone's input because we have a lot of creative people on staff... I am constantly amazed by the ideas that people come up with--things that I never thought of." All interviewees emphasized that testing is not just stage that occurs at the end of the development process, rather, it is a continuous process occurring at all phases (Dick & Carey, 1996; McDaniel & Liu, 1996). When asked, what would constitute a good reputation for doing **multimedia**, a developer said, "the ability to deliver on time"

Characteristics of **Multimedia** Development
Based on the interviews with the **multimedia** developers, several characteristics of the profession and some trends were observed. When a deal is obtained from a client, some companies will develop all pieces, while others will contract out parts such as audio and video or artwork. Many companies have only a few key personnel and maintain a large number of contractors. This enables them to stay flexible and more responsive to the changes of the field. Some set up virtual offices where they communicate with their clients and contractors through telecommunication channels. A few developers mentioned that when they contract out part of the project, they often look for people who could work at home. Similarly, companies maintain a balance between using stock footage and

creating their own. Many keep music and video libraries and have a working relationship with stock houses. More importantly, they all have the capability to create original media on their own. The length of the projects varies with regard to the scope and content, yet most fall between six months and a year. **Multimedia** development is a time-consuming profession. Many developers spend long hours, especially during the production phase. Some developers work more than 100 hours per week, while others tend to work between 40 and 50 hours each week. Project managers often work more hours than other personnel. Regardless of the number of hours, working through the weekend is quite common.However, the hard work is often rewarded by the creative nature of the field and the satisfaction of creating a product that can be enjoyed by others: "Creating a useful product is very, very gratifying. No two days are exactly the same. There is always something new." These creative aspects attract many energetic and talented people to the **multimedia** field.

Tips and Techniques in **Multimedia** Development
In the course of the interviews, the developers offered a variety of tips about
successful **multimedia** development. The following include some of the suggestions provided by the interviewees. Planning. Planning is the key to the success of most business endeavors, and this is certainly true in **multimedia**, where a lack of planning early in the process can be costly in terms of time later. All developers emphasized the importance of planning. Some pointed out that when a great deal of up-front planning was done with the client, it was easier to consider changes that the client requested at a later time as change orders, for which the client is expected to pay an additional fee. Some recommended carefully planning the amount of data that would be generated for graphics, text, audio, and video so that the final product did not exceed the 640 MB of disk space available on a CD-ROM. Others offered suggestions of getting everybody5 including the project manager, lead instructional designer, art director, and video/audio director, involved early in the process to "avoid pitfalls along the way" and to understand the limitations of the process from their perspectives. Finally, early testing on target machines-that is, the range of machines that are expected to run the final product-will help to guide the choice of media and activities designed for the product.
Time management. Skill in managing time in a **multimedia** environment is based on experience. Two specific suggestions relating to managing the schedule of a project were offered by the interviewees. First, in creating the schedule, plan on unexpected problems to arise near the end of the project: "There's a 9 to 10 rule. Supposedly when you have 10% left to do, you really have 90% of it--because that is when all the major stuff [problems] happens. So, try to stay ahead of your schedule." A second suggestion is to set milestones throughout the project. These milestones keep everyone working toward common goals and deadlines and create motivation throughout the project.

Personnel. **Multimedia** businesses depend upon the talent of their employees. Large companies may departmentalize, allowing employees to develop talents in one area only, but small companies should look for multitalented people who can perform a variety of jobs. In addition to the knowledge and skills particular to each position, interviewees recommended that companies seek out employees who were detail oriented, had an eye for **design**, and could relate well to others.

Contacts. Although **multimedia** companies can get work through grants and responses to RFPs (Requests For Proposals), many of the companies participated in this project had gotten at least some of their work through contacts they had made in graduate school programs and professional organizations. It is important to establish connections with people one knows; as one interviewee put it, "it pays to remember people's names and where they are [in which company]."

Reputation. In a field that is growing and changing as rapidly as **multimedia**, start-up companies will depend on their reputations both to attract new customers and get repeat business. A good reputation can also ease the production process. One interviewee who worked in the permissions department of a **multimedia** company

explained that because of the company's good reputation, she was able to negotiate for lower prices and get permission to alter some pieces of artwork: "Because of our good reputation with them [stock houses], we feel like we're able to get away with a lot more with them than other people can get away with .... They know we're going to treat them well. We're not going to hurt the art, and we're not going to misrepresent what the piece actually means." Another interviewee explained that reputation could play a role in communicating their competence in developing the technical specifics to clients. During the **design** phase, some clients may request a lot of changes while others are very hands off, "it depends on the trust level sometimes. If they [the clients] know your reputation, and know you're going to do a good job, sometimes they'll hand it over and let you go with it."

Communication with clients. The findings suggest that because many clients lack a familiarity with **multimedia**, the importance of educating the client as to the **design**, capabilities, and costs involved in **multimedia** development is critical: "I think the most difficult thing to learn when working in this business is learning how to tell the client what they really need. Clients come in with schemes, plans, grandiose **designs**, and it's real difficult to get them to focus on what they want to accomplish," one interviewee said. **Multimedia** development is an educational experience for both the developer and the client. In case of disagreements with the client on issues of content and **design**, it is important to remain diplomatic, to attempt to convince the client of the reasons for a differing position, and to abide by the client's final decision.In most cases, the clients have the final decision: "If we disagree, that's too bad. We just have to bite our tongues and go ahead and do it, even though we feel that there is a better way to do it." As one interviewee pointed out, "the bottom line is that the client is the one who has to like this [product], not the author." Some developers stressed the importance of continuous communication with clients to keep them informed of changes. As one developer put it, "I would emphasize the critical part of keeping the clients informed and making sure they have as much detail as possible so that nothing comes as a surprise."
Interface. Simplicity, consistency, and intuitiveness were three qualities recommended for interface **design** by most of the interviewees. Complicated **designs** are often confusing to users, and can sometimes age a product prematurely. One developer said, "If you stay away from the bells and whistles and the toys, what you're going to produce is something that's going to last."

Audio. Some companies are reluctant to invest in high-quality audio equipment because they believe that the audio in the final product will sound "computerish" anyway."People may listen to a computer game and say, 'It sounds terrible; and not see any reason to spend money trying to get the original recording of sound as good as they can. The danger here is that it will sound progressively worse. When the original recording is bad, the final recording will just degrade further and further" one audiographer explained. Therefore, developers are advised to invest in some hight quality audio equipment to produce better quality original sound.
Because audio consumes so much disk space, some audiographers suggest that prat grams using a background audio should use loops. These loops can be as short as nine seconds. However, the question remains, how does one create loops that short and yet they do not become annoying to the users? An audiographer advised, "Take the melody out. The melody serves the purpose of drawing your attention. That's the main thing you're listening to. In a **multimedia** presentation, the main thing you're list tening to should be the voice. If you do that, what you have left is a music track that's a little more passive but supportive. It won't be fighting the listener for attention."

Video. In **multimedia** production, video is compressed to reduce the amount of disk space it requires. This can lead to problems with the quality of the final digitized picture. To compress video, computers read only changes in pixels; the fewer pixels that change at any one time, the better able a computer will be to accurately handle the pixels that do change; the result being that the picture will look less jumpy. One videographer said that a video piece originally made for an analog medium can be difficult to digitize because "when there's continuous movement it's very hard to get a good-looking digital video image" To compensate for this problem, developers made two suggestions: (1) use a static background and (2) keep movements as subtle as the content of the video will allow.

If the overall goal of a **multimedia** product is interactivity, then developers need to avoid the trap of incorporating lengthy video clips in their products. Some mentioned that they never used clips longer than 15 or 20 s, at the end of which the user is given the control to request more of the video, or to continue with the program. Some interviewees cautioned other developers not to invest in creating a great deal of video, but to consider how the video will enhance interactivity in the final product before actually shooting the video.

Hardware and Software Used

The platform of choice for most of the multimedia developers interviewed was the Macintosh, though one developer used the PC exclusively. Most developers, however, owned PCs to do cross-platform development for their products. As World Wide Web technology advances and matures, the Macintosh or PC debate may become irrelevant. Many developers have already begun to do their **multimedia** development on the Web, which can be equally accessible from different platforms.

Macromedia Director (1996) was the most popular authoring tool cited by the developers interviewed; Macromedia Authorware (1996) was also popular, while Toolbook (1996)was used by the interviewee who developed exclusively on the PC. The latest releases of all three of these authoring tools offer some Web publishing capabilities.

Among the most popular graphics, 3D, audio, and video software were Adobe Photoshop (1996), CorelDraw (1996), PaintShop Pro (1996), After Effects (1996), Adobe Premier (1996), Fractal Painter (1996), Extreme 3-D (1996), Infini-D (1996), and SoundEdit 16 (1996). Programmers are typically expected to know a programming language well. The most common programming languages include Lingo, the programming language used by Director, and C + +.

How to Better Prepare Oneself for a Career in **Multimedia**

The findings of this study have clearly shown that being a **multimedia** developer is both a challenging and rewarding career. To be successful in this career, one should not only have some training and experience, but also possess some important characteristics. Based on the findings of this study, the following attributes are noted in a successful **multimedia** developer:

- flexibility,
- willingness to work hard and spend long hours,
- willingness to change what has been done to suit the needs of the client and changing technology,
- open-mindedness,
- willingness to learn,
- willingness to work with both creative and tedious parts of a project,
- ability to be detailed-oriented,
- ability to work under various constraints (i.e. time, resources, and/or budget constraints) and to be very creative given these constraints, and
- strong interpersonal and communication skills.
-

The developers interviewed for this project all started out in different fields and moved into **multimedia** in recent years as it has developed and grown. Although none of them offered one clear path to building a career in **multimedia**, they had several suggestions for students interested in this field.

Education is certainly one way to gain entry into **multimedia**. To many developers, however, education only opens the door. Many interviewees stressed the importance of getting on-the-job experience; "You really have to get your hands wet. Get in [the **multimedia** field] and do some simple stuff and then build up your experience,' one developer suggested. "Read books, understand how to do it, and then stick your nose in front of the computer to do it," another advised. In addition to taking courses in**multimedia** offered by universities and colleges, and getting a degree, these developers recommend that students should visit and be around people who are doing**multimedia** and get involved in a **multimedia** project so as to surround themselves with creative stimuli. Some developers suggest that students might also want to take advantage of more employment-oriented

community colleges, which can give them a quick start. More importantly, getting an internship or a temporary job is an excellent way to get involved and establish one's credentials.

To become a graphic artist, programmer, video producer, or audio producer, mastery of some popular technical tools is essential. The interviewees indicated that companies prefer to hire people who have computer experience and a good understanding of the limitations and capabilities of the tools they use. One developer suggested that people interested in building a career in multimedia should call the leading developers in the area, "find out what everybody's using as far as authoring ....and spend the next six months learning that software."
In addition to a good command of the technical tools, students interested in becoming a video/audio producers, graphic artists, or programmers should immerse themselves in as many diverse subjects as possible. "Be as varied as possible--writing, music, film, television, creative arts. The experiences in these areas will help" to produce a better product, one interviewee stated. One developer said he read "everything from futurist novels to old English history. Sometimes I get ideas from them." A programmer suggested that students should not only gain computer literacy on different platforms, but also study interface **design**. For students interested in becoming project managers and instructional designers, it is very important to gain some hands-on knowledge of how different **multimedia** tools work and their capabilities and limitations: "Get as much hands-on experience as possible. Even though you don't sit here and do it [that is, actual production], you are aware of the issues that can come up. You can ask the right questions and do your job better." The first-hand knowledge of how the tools work gives "you more credibility." The project managers interviewed agreed that knowledge of the **multimedia** tools and the experience of how the tools work is critical for being a successful manager: "To be good in**multimedia**, you just have to be as well-read and wide-read as possible in all areas."

Newcomers to this fast-paced and everchanging endeavor must also be prepared, both mentally and physically, for a steep learning curve of the production process and the software and hardware involved. They should be ready to learn constantly as new developments continue in this field. Though the interviewees did not offer suggestions for specific books on **multimedia**, they all agreed that reading trade magazines and reviewing software was crucial to know the current state of the field, as well as being aware of the competition and trying to stay ahead.
In addition, potential **multimedia** developers should learn to handle challenges from different perspectives. For example, a project manager and an instructional designer need to consider the clients needs, the end user's needs, the budget needs, and the programmer/artist's needs. "You've got to keep everybody's needs in mind and provide for their needs. Just the ability to keep up with a lot of details, and be persistent,' one developer stated. Some pointed out that such characteristics cannot be developed overnight or learned easily from the books. Therefore, students interested should consciously develop it by becoming involved in **multimedia** production and working in a real-world situation.

Finally, because **multimedia** development is often a group effort, companies look for people who can relate to other people in a team. For some companies, being able to work collaboratively and having a positive attitude is more important than having some technical skills. One developer made it clear: "Don't hire for skills, hire for attitude" It is possible to train people for the specific skills for the project, but it will be hard to train someone to be responsible. Another manager advised bluntly that, "if you are the sort of person who needs to work alone, find another business to get into."

SUMMARY AND CONCLUSIONS
The findings of the study provide information on the **multimedia** development process from a practitioner's perspective. They help clariS, to some extent, the mystery of what is involved in **multimedia** production, and they provide useful tips and techniques. The findings highlight some important components in the instructional **design**models: planning, designing, and testing. The **multimedia** development process appears to be more complicated, nonlinear, and interactive in nature than described in most of the

instructional **design** models. Unlike some models in which evaluation occurs only once and toward the end of the development cycle, the process of**multimedia** development as revealed by this study emphasized the need and critical importance for iterative and repetitive formative evaluation. For many companies, although summative evaluation is seldom conducted, both formal and informal formative evaluations are conducted on a continual basis and especially at each of the defined milestones to ensure the quality of the product. This finding is consistent with the few other studies (McDaniel & Liu, 1996) and literature on this topic (Apple Computer, 1994).

What is not reflected in some instructional **design** models, although dearly evident in **multimedia** development, is that the successful collaboration between the client and the developer, and among the various roles involved in the development process largely determines the success of a **multimedia** product. As **multimedia**development demands the cooperation of many highly skilled and talented individuals, division of responsibilities, smooth communication, and strong commitment to the objectives of the project are essential to make a project successful. The findings of the study have also shown that no one company follows one instructional **design**model strictly. Frequently, depending on the different objectives, audiences, and content of the projects, companies used a combination of techniques and principles in**design**. They customized the principles and made them workable for the projects.

Multimedia appears to be one of the fastest growing industries with a job growth rate of 13.6% for 1994-1995 (Schmit, 1996). Many people will be turning toward**multimedia** as a means of communication, entertainment, and instruction. Many students will be interested in making **multimedia** their career. For those who teach**multimedia** at colleges and universities, it is clear that much work needs to be done to better prepare students for the job market. The content and approach of teaching needs to reflect the changing nature of the field. In addition to providing a solid foundation in related theories, it is imperative to provide practical knowledge that meets students' needs in the real world. For those who are interested in entering this exciting field, one thing is obvious from this study: To be a successful **multimedia**developer, one must not only be willing to invest time and effort in keeping current with the development of the technology, but also enjoy the challenges and opportunities of lifelong learning provided by the profession. One developer summarized the **multimedia** profession well: "You get paid to have fun."

LIMITATION OF THE STUDY

We realize that the information presented in this study only reflects the perspective of a small group of **multimedia** developers. The findings may not reflect the practice by all other **multimedia** companies around the country. By including a variety of companies and interviewing people with as many different roles as possible, we hope to show at least the process used by those small to mid-size **multimedia** companies in Austin, Texas. Because Austin has such an active **multimedia** community and a reputation for its high-tech industry, it is hoped that what is presented here will provide useful insight for understanding the **multimedia design** and production process and will serve as a starting point to provide information to students interested in getting into a **multimedia** career.

Contributors

Min Liu is an assistant professor in the instructional technology program at the Department of Curriculum & Instruction, University of Texas at Austin. Her teaching and research interests include investigating the impact of interactive **multimedia**/hypermedia technology on learning for all age levels and designing effective learning environments with the technology. Colleen Jones and Susan Hemstreet are both PhD students. Colleens research interests include Web-based instruction, hypermedia**design**, and hypermedia environments that support cognitive processing. Susan is interested in hypermedia-supported collaborative learning, student authorship of hypermedia documents, and problem-based learning. (Address: Min Liu, Department of Curriculum & Instruction, University of Texas at Austin, Austin, TX 78712; mliu@mail.utexas.edu.)

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                        Table 1
        Descriptions of Some Key Roles in Multimedia Development
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```
Roles              Responsibilities

                   (What do they do?)

Project            * Writes proposals
Manager            * Oversees all aspects of the process
                   * Coordinates efforts of all
                     other roles
                   * Interacts with clients
                   * Makes sure client's needs are met
                   * Makes schedules
                   * Makes sure deadlines are met
                   * Resolves conflicts between a
                     developer and a client
                   * Evaluates the work the team
                     produced at every phase
                   * Keeps the project organized
                   * Keeps the project on budget
                   * Generates tools to facilitate
                     development process
Instructional      * Determines a clients needs
Designer           * Analyzes what has been done
                     on the topic in the past
                   * Writes instructional objectives
                   * Interacts with clients
                   * Determines how to test learners
                     and creates test items
                   * Selects appropriate delivery media
                   * Selects appropriate strategies
                   * Creates the master design
                     document that details all the design
decisions
                   * Creates storyboards/flowcharts
                   * Evaluates and ensures what is
                     designed meets the clients' needs and
                     objectives
                   * Creates prototype
                   * Supervises the production to
                     ensure the design decisions are implemented
                   * Consults with the client for any revision
                   * Participates in the production
                     process (writing scripts, tides,
                     selecting images, video and
                     audio sources, etc.)
Programmer         * Gets involved in the design process
                   * Is familiar with storyboard and
```

uses it as a guideline
                 * Studies the problem and comes
                    up with solutions and fixes bugs
                 * Writes clear, concise, understandable, and
                    reusable codes
                 * Communicates with designers
Videographer   * Locates audio and video
and   resources
Audiographer   * Selects appropriate audio and video clips
                 * Casts characters and works
                    with audio and video talents
                 * Creates audio and video clips
                 * Interacts with instructional
                    designer and project manager

    Roles   Characteristics
                 (What should they be able to do?)

Project   * Help team members
Manager   make decisions on priorities
                 * Manage people and crisis
                 * Motivate people
                 * Talk comfortably to different members of
                    the team using their languages (professional
                    jargon)
                 * Focus on ultimate objectives and have
                    big picture in mind
                 * Be detail oriented
Instructional   * Have a good grasp of
Designer   instructional **design** knowledge and be
                    familiar with different **design** models
                 * Have excellent communication skills
                    and be able to relate to the client and
other
                    roles in the team
                 * Talk comfortably to artists, videographers,
                    audiographers, programmers using their
                    languages (professional jargon)
                 * Have a good eye for **design**
                 * Listen intelligently
                 * Be familiar with authoring tools
                 * Break a project into manageable pieces
                 * Be detail oriented
Programmer   * Have good problem-solving skills and enjoy
                    solving problems using the resources
available
                 * Have a solid background in programming

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                    * Be able to communicate with other team
members
                    * Be detail-oriented
Videographer        * Be creative
and                 * Have good background in
Audiographer          audio and video production
                    * Be detail oriented
                    * Be able to communicate with other team
members
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APPENDIX INTERVIEW QUESTIONS

All interviewees were asked the general questions. Depending on the role each interviewee played in the process, appropriate questions were asked using this list.

General Questions

Background

- Describe your background, role, and relationship with other members.
- What is your educational background, and how did it prepare you for this job?
- What prior experience do you have, and how did it prepare you for this job?
- What course of study do you think would best prepare someone for your role?
- What education and work experience would an employer look for when hiring someone to work in your job?
- What books would you recommend for a beginning **multimedia** developer?

Department

- What are the main duties of your department?
- What is the role of your department in the **multimedia** process?
- What kind of expertise do you look for in hiring new people for your department?
- What hardware is most commonly used in your department?
- What software is most commonly used in your department?
- How often do you meet as a team and what subjects do you discuss? How do team members communicate with each other? How important is the weekly/monthly meeting?
- What are the pitfalls of a team?
- Do people in your department play different roles? If so, what are those roles?
- Do you conduct any evaluation, if so, what kind and how?

Prototype

- What is your role in developing the prototype?
- How is the prototype related to the final product?
  Client
- Do you have direct contact with the dient, or does someone else in the company handle those interactions? How do they do that?
- How do you deal with the client? Do you agree with your client all the way? In the case of a disagreement, how do you handle that?
  Project
- Do you have input in the vision of the project?
- At what point in the production process do you first become involved?
- What other roles do you work closest with and why?
- At what point do you stop working on a title?
  Personal
- What are some major obstacles you face in doing your job?
- What aspects of your job do you like most?
- Do you have experience in any other roles in a **multimedia** company?
- What advice would you give someone who wanted to become a ?
- What type of qualities would you personally look for in a --?
- Can you think of any examples of lessons learned from experiences in the field?
  Fact Checker Questions
- What are some major external obstacles your department faces when working with the client?
- What are some major internal obstacles your department faces when working with the instructional designers?
- How do you decide if a source is reliable?
- How many sources do you try to identify to verify your information?
- Does instructional content ever need to be changed because acceptable sources are unavailable, or do you keep looking until you can verify the facts?
- Does your need to verify facts limit your ability to draw conclusions and make inferences? If so, in what way?
- Who is liable for content areas?
- How do you coordinate with instructional designers?
- How do you coordinate with graphic designers/artists?
- How much do you need to know about quality assurance?
  Authorer Questions
- What authoring tools are most commonly used in **multimedia** development?
- What is your preference of authoring tools? Why?
- How is a tool chosen for a specific project?
- What is the key equipment necessary for authoring?
- Do you work with the instructional designers to insure that their **designs** are feasible?.
- Do **designs** ever need to be altered after they have been approved because they are unfeasible from a production point of view?
- How do you communicate the scope of a change you are requested to make?
- What's the relationship between authoring and programming?
- Should authors know some programming?
- Do you develop and use templates?
- Do you work from a style guide. If so, how is it created and who creates it?
- How many levels do you suggest in a **design**? For example, you may have a main menu, then a directory, and then particular screens tied to the directory...
- What's the process for collecting all the pieces you use in the title?
- How is the interface designed?

- Would you share with us your "ideal" interface?
- What kind of characteristics should an "ideal" **multimedia** interface have?
  Permissions Questions
- What percent of pieces you request for a project actually end up in the final product?
- Would the source want to retain editorial rights over those changes?
- What portion of the cost of a project is typically spent on obtaining permissions for art?
- How do you estimate the budget required to obtain permissions?
- What types of licenses and permissions must you obtain in putting together a **multimedia** product?
- Do most licenses/permissions allow you to alter a piece of art?
- What regulation should be imposed on **multimedia** development? When do you think regulation procedures will be enacted?
- What are some major obstacles you face in obtaining permissions?
- Does the **design** process allow sufficient time for you to obtain the requested art work?
- What percent of your budget do you spend on permissions?
- Does your company create original art work/audio/video/etc? If so, how do you do it?
- Do you find that more people are willing to work with you because you're doing an educational product?
- What are the steps in the process of obtaining art?
- What types of fees are involved in acquiring art?
  Director/Project Manager Questions
- How do you acquire contracts?
- Do you meet with the client? If so, how often? Why is it important?
- What type of prototype is necessary?
- In what way do you utilize user*testing?
- Which roles are involved in developing the prototype, how many?
- Which roles are involved in the **design** phase, how many?
- Which roles are involved in the production phase, how many?
- How do you distribute the title?
- What types of follow-up do you engage in?
- What kind of people do you like to hire, what kind of qualities are you looking for, how will new people get better prepared?
- What method is used in testing the product? If focus group, how is it utilized?
- Does the client typically supply any content? thematic direction? background?
- Does the client usually own the copyright of the content and gain ownership of the copyright of all pieces of the project?
- How does your company handle legal aspects? business aspects?
- What qualities do you look for in a lawyer or business consultant?
- Who is in charge of the budget in your company?
- Have you had any clients return for repeat business with you? Why do you think so?
  Programmer Questions
- Do you have input regarding the difficulty of programming the **design**?
- Do you ever have to say, "This **design** is too complicated. Let's do it this way instead"? For example, you are asked to write a function in a particular module in C+ + which you think should be done in Lingo?
- Do you ever make any changes in the **design** you are given to author? Do you have to get permission to make these changes, and from whom?
- Has your company ever created a prototype to help in public relations?
- What types of follow-up do you engage in?
- What is the relationship between programmer and authorer. How do you work together?
- How do you utilize the instructional designers?

- How do you work with the instructional **design** team?
- What software/languages do you use? Why?
  Artist Questions
- How do you decide the visual schema for a project?
- How do you decide on a typeface for the text?
- How are the ground rules for a project set?
- Are you involved in creating the storyboard/flowchart? Who is responsible for storyboarding in your company?
- Is the interface **design** a big issue to you? What are some concerns that clients have with interface **design**?
- What do you think are the keys to a good visual graphics in a tide?
- Do you use gender-specific or ethnic-specific artwork, and if so, under what circumstances?
- Do you often have to use color-codes/**design** that the company wishes to use?
- Is your artwork consistent?
- Do you create your own artwork more or use copyrighted materials?
- Do you utilize photographers for projects?
- Do you help with the creation of the cover or public relation materials for the tide?.
- How do you utilize the instructional designers/permissions department/authors?
- What hardware do you use in creating artwork?
- What software do you use in creating artwork?
- What are the tools of your trade?
- What are some rules of good icon **design**?
- Are there any legal implications in designing your artwork? Ex. Creating an icon from a picture?
- Do you work from a style guide and if so, what is it?
- How do you balance production and creativity?
- Do you ever hand-draw your art and then scan it in?
- At what point do you confer with the instructional designers or client if you have laid out the screen, created a color scheme, and have a visual balance? Do they often change the **design**?
  Animator Questions
- What role do you play in creating/developing animations?
- Do you work with designers in creating animations?
- How are drawing skills and the ability to create movement used in animation?
- Are animations utilized in the **design** and prototype stages?
- Which programs do you use to create your animations? Why?
- How is the style of the animation communicated to you?
- Does animation affect the budget/timeframe of the project?
  Instructional Designer Questions
- Are you invited to the "kick-offs" with the clients?
- Could you describe the relationship with the client?
- How many instructional designers may be involved in developing the prototype?
- Are the prototypes a segment of the title or a totally separate project?
- Do you often create more than one prototype?
- How does the prototype limit you in the production of the entire title?
- Are you involved in creating the storyboard/flowchart? When do you begin to create it?
- What aspects of your storyboard are often subject to editing?
- Are you involved in the formative evaluation?
- Is the interface **design** a big issue to you? Do clients have trouble with interface **design**?
- What do you think are the keys to a good interface **design**?
- Is the instructional **design** a big issue to you? Do clients have trouble with instructional **design**?
- What do you think are the keys to a good instructional **design**?

- How do you make a **design** inviting and fun?
- How is navigation utilized in your **design**?
- Are you often requested to use gender-specific or ethnic-specific **designs**?
- How do you decide to use text, visuals, or interactions in your **design**?
- What types of transitions do you employ in your **designs**?
- What type of feedback do you use in your **design**? Why?
- Do you often have to use color-codes/**design** that the company wishes to use?.
- Do you often use a guide in your **design**?
- Do you ever find that vogue values shape what is in your **design**? Ex. Would you include a picture of tobacco in a **design**?
- Do you try to address different learning styles/ability levels in your **design**?
- Are your **designs** consistent?
- Do you prefer learner controlled **designs**?
- How do you build interactivity into your **designs**?
- How many levels (from the main menu) do you suggest in a **design**?
- Where do you like to display instructions?
- How do you utilize the artist?
- How do you utilize the author?
- How do you utilize the programmer?
- Who should be responsible for content? Client or instructional designer?
- What is the source for your content? Originals, recycles, licensed, or in the public domain material?
- What are the legal aspects of the content you use? Ex. Are there different laws for using a quote?
- How do the subject matter experts contribute to the **multimedia** application?
- What do you look for in qualifications for a subject matter expert?
  Writer/Editor Questions
- How much of the screen do you reserve for text?
- How is the vision/tone of the project communicated to writers/editors?
- What role do you play in creating documentation of the project?
- What role do you play in writing the proposal of the project?
  Videographer Questions
- Do you use video for on-the-scene reports or interviews?
- Who is responsible for the script and storyboard of the video?
- How do the amount of storage space affect the use of video?
  Audiograpber Questions
- When is voicerover utilized over text?
- How does sound affect the **design** of the **multimedia**?
- How does the location the **multimedia** will be used affect the sound?
- How does the company find voice talent and musicians? Are they kept on staff?
- How does the voice affect the mood and emotion of the project?
- How often is background music employed in a project?
- What separates a good versus bad voice for a **multimedia** project?
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