The Online Resource Selection Instructional Design Script (ORSIDS)™ and Implications for the Selection and Evaluation of Multimedia Learning Objects

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INTRODUCTION

Flashback: an interview with a technology savvy professor about the implementation of online engineering learning at his institution. This interaction occurs as part of a 2002 study on North American online learning implementation sponsored by the French government and a consortium of French colleges. As the study subject demonstrates the bells and whistles in a state-of-the-art lab designed to assist faculty with online learning, he confides that at times he still has trouble figuring out how to translate certain concepts from his face-to-face teaching for online delivery.

My silent response to his confidence was to hypothesize the existence of learning objects that would allow this educator to teach these concepts, learning objects of which he was unaware. I further hypothesized that if this faculty member were knowledgeable about traditional instructional design theory, and in particular media selection, that he would be empowered to identify the type of learning object(s) needed to teach the concept(s) that he was now baffled about how to present.

I tested this hypothesis through a study in which a product was developed to teach educators instructional design theory in the context of developing their own online classes. The Online Resource Selection Instructional Design Script (ORSIDS)™ is a process “script” to assist consultative college-employed
instructional designers in guiding faculty with selecting learning objects for their online courses (Cohen, 2005). ORSIDS™ was designed to address the problems of the lack of online pedagogical skills possessed by online faculty (Ellis & Hafner, 2003), the less than effective deployment of the college-employed instructional designers increasingly being hired by colleges and universities to work with online faculty, and the lack of educator adoption of online resources, particularly the learning objects and learning object repositories into which numerous organizations worldwide have invested significant financial resources.

This paper will discuss:

- The instructional design and communication theories upon which the product and process were based.
- The methodology employed to develop the process and products and to test their efficacy.
- The results of the study - how effective was the process and methods of knowledge transfer?

**BACKGROUND**

This study investigated the efficacy of the use of a process script for learning object identification, searching and evaluation for online courses. The Online Resource Selection Instructional Design Script (ORSIDS)™ is a process “script” primarily based on the ASSURE instructional design method (Smaldino, Russell, Heinich, & Molenda, 2005) integrated with many elements from media selection models (Briggs & Wager, 1981; Kemp, 1980; Reiser & Gagne, 1983; Reynolds & Anderson, 1992; and Romiszowski, 1988). Media selection models are based on
sound instructional design principles and delineate simple, systematic processes for making media selection decisions (Cohen, 2005).

This study was based on the following premises:

- As learning objects are comprised of multimedia, they can be thought of and treated in a similar way.
- Multimedia share the attributes of media, but since multimedia consists of two or more media, there is the need to consider constraints related to cognitive load.
- By leading online faculty members through a process based on instructional design methodology, these faculty members can be prompted to identify their curricular needs for learning objects.
- A cognitive tool, or script, can be developed to assist instructional designers in implementing this process.

An intensive review of literature on media selection took place prior to developing candidate criteria, or requirements, which were then validated by an expert panel. Many of these requirements were steps in the ORSIDSTM process. “Select methods, media and materials” is the third step of the ASSURE model (Smaldino, Russell, Heinich, & Molenda, 2005, p. 59). Included in this step is an appraisal checklist of selection criteria for each media type that begins with the question: “does it match the curriculum?” The goal of this study was to develop a script to answer this question for learning object candidates. Additionally the purpose was to aid the consulting and conceptualization/elicitation process.
(Keppel, 2000) between the instructional designer and online faculty member in the area of the selection and evaluation of online learning objects (Cohen, 2005).

A process was created for the instructional designer to guide the online faculty member in finding learning objects and to then determine whether they were appropriate for the curriculum. Determining whether or not a resource is appropriate for the curriculum is based on the knowledge of instructional attributes of various media and how they link to different learning outcome types. This knowledge was derived from the literature on media selection models, which has an important place in the field of Instructional Design and Technology (Richey & Nelson, 1996).

A media selection model is a prescriptive technique that provides a systematic and streamlined way for designers of instruction to analyze the concepts that they are endeavoring to teach, devise instructional strategies and find the corresponding media to best convey them (Cohen, 2005). From the 1960s through the early 1990s, prior to the advent of Web-based courses, a plethora of different media selection tools were available. The study developed a script based upon the foundation of the research findings on media selection from the field of Instructional Design and Technology (Clark, 1999; Reiser & Gagne, 1983; Reynolds & Anderson, 1992; Romiszowski, 1988; Smaldino, Russell, Heinich, & Molenda, 2005). As multimedia selection makes it necessary to consider issues related to cognitive load (Cohen, 2004), the script was based upon findings by Mayer and colleagues (Clark & Mayer, 2003) related to cognitive load as well.
A number of factors must be considered in the multimedia selection process. They include: (1) the learning task and the instructional conditions that facilitate the learning; (2) the characteristics of the learners; (3) the learning context and other constraints that affect the choice of medium and (4) the attributes of each medium (what each medium is capable of with regard to the three previous factors) (Cohen, 2005; Smith & Ragan, 1999). Physical attributes of media are the physical aspects of communication that the media are able to display, for example visual displays make it possible to teach concrete concepts, such as shapes and objects and spatial relationships such as locations and distances. Instructional attributes of media are how the media supports the type of performance expected of learners as a result of the instruction. Media differ in their ability to support various types of expected performance. For example, when concepts involving spatial relationships are being learned, pictures are a much more effective medium than verbal descriptions. These and many other elements of media selection were integrated into ORSIDSTM. This paper will provide a discussion of the theoretical underpinnings of the ORSIDSTM process script, the script’s composition, and the results of the study which established the value of teaching instructional design methodology, and in particular media selection, to faculty members to assist them in selecting and evaluating learning objects for their online courses.

The scenario for the use of such a script is the elicitation/conceptualization process that occurs between professional instructional designer and online faculty member when collaborating in the development of an online course. The larger context for this scenario is that of an instructional designer/online faculty member
relationship in which the instructional designer serves as change agent (Schwier, Campbell and Kenny, 2004), guiding the development of instructional materials while simultaneously diffusing technology into the teaching practice of online faculty members. In this ideal instructional designer/online faculty member relationship, faculty members learn the instructional process, growing in time to be able to take increasing responsibility for the development of online materials until they are completely independent. The specific technology diffused by the professional instructional designer in this scenario consists of learning objects and other online digital resources.

Instructional design theory has much to contribute to the sound pedagogical use of learning object systems (Bannan-Ritland, Dabbagh, & Murphy, 2000; Smith & Ragan, 2005). The field of learning objects developed independently of instructional design theory, and pioneers from the field of instructional design such as David Merrill (Bannan-Ritland, Dabbagh, & Murphy, 2000) have been working retroactively to develop the necessary underpinnings for the effective educational use of learning objects. ORSIDS™ shares differences and similarities with other systems developed to link the usage of learning objects with instructional design theory.

Like Merrill’s IDXelerator™ (cited in Bannan-Ritland, Dabbagh, & Murphy, 2000), ORSIDS™ is grounded in traditional instructional design theory based on Gagne's Events of Instruction (Gagne, Briggs, & Wager, 1992). However, ORSIDS™ is primarily based on media selection theory (Briggs & Wager, 1981; Kemp, 1980; Reiser & Gagne, 1983; Reynolds & Anderson, 1992; and

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Romiszowski, 1988) which in general extends Gagne's theories while being derived from them.

What distinguishes ORSIDS™ from other models whose purpose is to inject pedagogy into learning object use is its goal of technology integration for educators, its interpersonal orientation, its pragmatic orientation exemplified by grounding in a specific context and empirical development and testing, and its foundation in media selection theory and multimedia theory. For a time, media selection was a strong focus of the Instructional Design and Technology field. Instructional Design and Technology theorists developed criteria for media selection; these criteria can form a foundation for making decisions about which learning objects should be selected for inclusion in online courses. Additionally, the online environment often results in the use of multimedia, two or more media presented simultaneously. Multimedia selection differs from media selection because issues of cognitive load must be considered. Considering the instructional attributes of media and how learners cognitively integrate information provides a foundation upon which to assess whether to use and how to implement learning objects in online courses.

Because a primary goal of ORSIDS™ is to enhance educator technology integration, a chief challenge in its design was how to best facilitate knowledge transfer. Thus the choice was made to take advantage of the superior productivity often resulting from small groups (Hill and Laughlin cited in Johnson, 1992) with a product, a script, that would be delivered person-to-person, rather than an automated product such as Merrill’s IDXelerator™.
Although ORSIDS™ can be adapted to numerous contexts, it was originally designed for a higher education context in which a consultative instructional designer is employed to assist faculty members with the design of their online courses. The context was assumed to be one in which learning object design and development would occur rarely, if at all, and in which identification and searching online for useful learning objects would be routine.

Because ORSIDS™ was developed through formative and summative evaluation in an empirical manner, it is very much grounded in practice. It was developed to address three problems: lack of online design skills on the part of faculty, lack of use of learning objects, and lack of infrastructure to support college-employed instructional designers. Thus ORSIDS™ was evaluated on its ability to address these three problems it was created to solve as well as on its own merits as a communication tool.

A major distinctive feature of ORSIDS™ is its identification of learning objects as media and multimedia, resulting in a strong foundation in media selection theory (Briggs & Wager, 1981; Kemp, 1980; Reiser & Gagne, 1983; Reynolds & Anderson, 1992; and Romiszowski, 1988) and multimedia theory (Clark & Mayer, 2003). Media selection theory represents the collected wisdom gathered in the 20th century related to the educational uses of media, and multimedia theory is the groundbreaking work currently being done using scientific methods to test the educational efficacy of various implementations of multimedia.
The requirements for ORIDS™ were gathered through a survey of a number of media selection models and procedures and utilization of their most highly rated features. This made it possible for ORSIDS™ to integrate a process for the selection and evaluation of learning objects in addition to a wealth of information about the educational attributes of various media applicable to learning objects.

Definitions

Learning Object

“Learning objects” has several definitions. The definition used here is the following IEEE definition developed during the standardization process (IEEE, cited in Conole, 2002, p. 5): “A learning object is any entity, digital or non-digital, which can be used, re-used and referenced during technology-supported teaching”.

Script

The term “script” is based on its use by Keppell (2004) who wrote that instructional designers rely upon experts and utilize a design model consisting of a set of representations and generic strategies to accomplish their goals. “Instructional designers are process oriented individuals who have a set of representations based on a ‘design model’. The design model can be seen as analogous to a script, a

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knowledge packet in memory which allows us to understand routine activities. The designer has a generic script which can be applied with variations to new educational problems.”

THEORIES OF LEARNING DESIGN AS AN ENABLER OF EDUCATIONAL LEARNING OBJECT USE

Many learning objects exist online. Online instructors can incorporate them into their classes for use with a wide range of teaching activities. Such learning objects include digital materials displayed on websites such as the PBS site accompanying the Ken Burns jazz series (http:www.pbs.org/jazz/lounge/) to more structured environments and data stores including managed and virtual learning environments and digital libraries as well as information gateways and portals (Conole, 2002). The Multimedia Educational Resources for Learning and On-Line Teaching (MERLOT) (http:www.merlot.org/help/FAQ.po) is a national gateway to web-based peer-reviewed learning materials and a successful demonstration project (Johnson, 2003). Learning object repositories are another example of online searchable collections of digital educational resources that are available online (Boyle, 2002).

While quality learning objects can add a great deal to an online course, they are expensive and time consuming to produce. Designing such materials is outside of the scope of what most individual instructors can reasonably be expected to do as part of their routine workload. To facilitate the development and
sharing of such resources, governments around the world have spent large sums of money on initiatives to develop learning objects, methods through which to file and search them (metadata), and online repositories in which to store them (Friesen, 2004). However, there has been a general lack of adoption of learning objects and repositories for them.

Gosper, Woo, Gibbs, Hand, Kerr and Rich (2004) found that a major reason for the reluctance of educators to share and reuse these objects is a lack of understanding of how such objects can apply to the learning outcomes they plan to achieve. Additionally methods through which to customize the objects and the applicable copyrights are hard to understand. Friesen (2004) compared educator resistance to learning objects with other technology-originated innovations introduced into educational settings. He wrote that the problem with such innovations resulted from the fact that such innovations are introduced “bearing the stamp” of their technical origins rather than in terms meaningful to educators. Yet when educators appear to resist such innovations, they are blamed for not readily adapting to them. Friesen cited Rogers (1962) who found that the rate of adoption of innovations by educators increased significantly when the innovations display simplicity, compatibility with the practices of the environment, and apparent advantages as compared with “business as usual”. Thus the provision of learning objects and related infrastructure alone will not lead to their adoption (Gosper et al., 2004.). A bridge needs to be created enabling educators to understand their use.
Instructional designers are perfectly situated to provide this bridge. Knowledgeable about learning theory and in the use of technology, skilled communicators who are familiar with the needs of educators and the higher education context, the instructional designer is well equipped to serve as a bridge between available technology and its use by educators.

The instructional designer function in higher education is two-fold: instructional designers (1) design and develop online course materials and (2) facilitate changes in how academics think about teaching and learning (Torrisi-Steele & Davis, 2000). The instructional designer role of higher education change agent is an important one (Schwier, Campbell & Kenny, 2004). Essentially, the instructional designer facilitates innovation in colleges and universities through taking an active role in the professional development of teaching staff, enabling them to develop skills to produce online courses and to teach online (Torrisi-Steele & Davis, 2004). This instructional designer role can include introducing faculty to learning objects.

The instructional designer translates the needs of the client, or faculty member, into a plan to produce a product to meet that client’s needs (Liu, Gibby, Quiros & Demps, 2002). The instructional designer guides the client through the design process, eliciting needed information and providing the necessary information to the client to enable him or her to make the correct design decisions. Instructional designers are essentially problem solvers who invent solutions as a routine part of their work (Schwier, Campbell & Kenny, 2004). Because the instructional designer has knowledge of both technology and educational needs, his or her
communication skills make it possible to serve as a bridge between technological innovations and the educator (Liu, Gibby, Quiros, & Demps, 2002). Learning objects are one such technological innovation that the instructional designer can make accessible to the educator.

Johnson (2003) found that an enabler of educational learning object use included learning design, or the theories and techniques of teaching and learning that ensure successful learning outcomes. The finding was that while such a body of knowledge exists and is sufficient, it is not widely understood. To make the circumstances surrounding the use of learning objects more favorable for adoption, such knowledge must be disseminated.

The purpose of this study was to collect this information and communicate it in such a way that it could be understood and applied in real-world settings to make effective learning object use possible. An extensive review of literature was conducted centering on media and multimedia selection theories and processes. A summary of these theories and processes follows.

**Media and Multimedia Selection Theories and Processes**

This study focused upon three types of media selection models, referred to here as *Quick Reference Media Selection Models, Inclusive Media Selection Models, and Procedures for Media Selection* (Cohen, 2005).

A Quick-Reference Media Selection Model is a performance support tool that makes it possible to come to a media selection decision in a relatively short time. An Inclusive Media Selection Model is a more complex performance support tool that provides a reference function. Procedures for media selection lack the
guidance to actually lead the user through the Media Selection process. However, the procedures discussed here offer much of value in enabling users to arrive at good media selection decisions.

The following important factors of media selection are addressed to varying degrees by the media selection models (Gagne, Briggs & Wager, 1992):

- The media types included for consideration
- Physical attributes of media – the physical aspects of communication that the media are able to display, for example visual displays make it possible to teach concrete concepts, such as shapes and objects and spatial relationships such as locations and distances. Some models merely specify “visual display” and others make finer distinctions such as “photos” and “graphics”. The physical attributes of multimedia can further be defined by the technology that they employ. For example, the limiting size and resolution of some computer screens makes them harder to read from than a book, presenting obstacles to learning. The processing abilities that can operate on available symbol systems are also a factor (for example, information can be searched on a videodisc in a way not possible with broadcast video). Media selection models include these physical media attributes to a greater and lesser extent.
- Instructional attributes of media – how the media supports the type of performance expected of learners as a result of the instruction. Media differ in their ability to support various types of expected performance. For example, when concepts involving spatial relationships are being
learned, pictures are a much more effective medium than verbal
descriptions. Depending upon the type of spatial relationship, the use
of one kind of picture, such as a photograph, may be much more
effective than another. Intellectual skill learning requires a medium
that can present multiple examples, question the learner about the
examples, and provide feedback about the accuracy of the learner’s
response. Print-based computer training and interactive multimedia
would both be capable of fulfilling these requirements. Models vary
not only in the instructional attributes that they include but also to the
extent that they guide users in making these determinations (Criticos,
1996).

• The learning outcome system utilized to classify the learning task -
many models use a classification system based on that proposed by
Gagne (Gagne, Briggs, & Wager, 1992), but not all do. Gagne’s
learning outcome classification system includes Intellectual Skills,
Cognitive Strategies, Verbal Information, Motor Skills, and Attitude.
The classification of learning outcome types is important for media
selection because individual learning outcome task types tend to be
best taught through specific instructional strategies (Smith & Ragan,
1999). Such instructional strategies are most effectively
communicated through the use of particular media and combinations
of media (Clark, 1999).
Learner variables – Media selection models consider learner variables to varying degrees. Learner variables include such factors as ability to read and age of the learner.

Various environmental factors including practical matters such as budget and the availability of resources associated with the learning environment and the development environment. Cultural considerations may also be a factor.

Other important factors related to media selection models (Reiser & Gagne, 1983) include:

- Whether the model has been tested and the protocols used
- At what level of granularity (such as learning objective or event of instruction) the selection model is to be applied
- The display format of the model
- The usability of the model, including the clarity of verbal descriptors and the effectiveness of the guidance or scaffolding (Shneiderman, 1998)

**Quick Reference Media Selection Models**

This section discusses the Reiser Gagne Media Selection Model (1983) and the Kemp Media Selection Model (1980), examples of Quick Reference Media Selection Models which make quick media selection decisions possible.

The most prominent of the Media Selection Models is the Reiser Gagne model (1983). This well-tested model was cited as an example of media selection models in a number of contemporary instructional design textbooks (Dick, Carey

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The notable features of the model included a very usable format combining flowchart and matrix worksheet, very clear verbal descriptors with definitions provided as well, and the necessary performance support for a user to easily navigate through the model (Romiszowski, 1988). Simplicity is a great strength of the Reiser Gagne model; its many rounds of formative testing are evident in its usability. However, the model provides a limited number of media from which to choose and comparatively little detail about the physical and instructional attributes of media. Were these factors not abbreviated, all the elements related to one instructional context couldn’t fit onto one page.

The Reiser Gagne model, like that of several others, suggests a procedure consisting of the following tasks:

- Categorize learning outcomes
- Plan instructional events to use to teach each learning outcome
- Identify types of stimuli necessary to present events
- Identify media capable of presenting stimuli

Reiser and Gagne suggested that users choose their own desired granularity for their media selection decisions but recommend that the decision be at the level of the learning objective.

The Kemp Media Selection Model (1980) consists of three charts classified by the instructional context. Unlike the Reiser Gagne model, the Kemp model does not consider the learning outcome type of the task or the instructional attributes that media can provide. In place of learning outcomes, this model asks the
designer to consider whether what is needed includes (1) verbal abstractions, (2) direct concrete experience, or (3) vicarious or sensory experience. Novices may find it difficult to make this determination without support and/or further definitions. However, the idea behind this approach is intriguing in that it could potentially enable the user to make quick decisions about how to treat much of the material without having to consider each learning objective. This model also includes many media types and physical attributes of media; for example, within graphics it lists diagrams, charts, pictures, cartoons, and picture books. However, the model does not include the instructional attributes of media, and little guidance is provided enabling the user in deciding why to choose one media type rather than another. The literature does not report that this model was tested.

**Inclusive Media Selection Models**

The two inclusive media selection models discussed here are the Romiszowski model (1988) and the Reynolds and Anderson model (1992). Much useful information is provided in both, but the complexity of the material makes the media selection process somewhat cumbersome. Both models include much detailed information about many media types as well as the physical and instructional attributes of media. Neither model purported to be a quick reference. Romiszowski saw his model as a handbook, Reynolds and Anderson a mini-textbook.

The Reynolds and Anderson model presents its information through multiple flowcharts that are keyed to one another to aid the user with navigation. The Romiszowski model contains much valuable information including flowcharts.
about (1) decisions for matching learning tasks to media characteristics, (2) decisions for selecting visual media and (3) decisions for selecting verbal and sound media. According to test results, the Romiszowski model (1988) improved the media selection decisions of the educator subjects who tested it.

**Procedures for Media Selection**

The Briggs and Wager procedure (1981) and the ASSURE Model by Smaldino, Russell, Heinich, and Molenda, (2005) are two procedures for media selection. The literature does not report that either was actually tested. The Briggs and Wager procedure is very thorough, including many considerations necessary for media selection. The ASSURE Model is a procedure for planning and delivering instruction (Smaldino, Russell, Heinich, & Molenda, 2005) that is oriented toward classroom use. The acronym ASSURE stands for the following: Analyze learners, State objectives, Select media and materials, Utilize materials, Require learner performance, Evaluate/Revise. ASSURE considers the learning outcome classification system an important element of media selection. The authors presented the Reiser Gagne media selection model (1983) as a sample media selection schema, but stated that the book’s purpose is to help readers to devise their own media selection schemas. A very important feature of the model is that there are three alternative methods for obtaining the desired media: selecting available materials, modifying existing materials, or designing new materials. The authors made the important point that in the busy world of the classroom teacher or faculty member, designing new materials is rarely an option. If existing materials are available that will meet a given need, it is advantageous
in the classroom context to select them and modify if necessary. ORSIDSTM
adopted this approach in emphasizing the search for preexisting learning objects.

The content of ORSIDSTM was highly influenced by these models and
procedures as well. The procedural steps were integrated into the steps of the
ORSIDSTM process, and content related to media use was compiled and used as
subject matter delivered in the script.

**Overview of the Method Used in the Development of ORSIDSTM**

Development methodology was used in the study.

- A review of literature and other information gathering took place in
  the *Pre-Design Phase*. Establishing formative and summative review
  committees also occurred in this phase.

- The *Design Phase* consisted of candidate requirements development,
  and in this phase members of the expert panel validated the
  ORSIDSTM product requirements at a series of meetings facilitated
  with use of the Nominal Group Technique (Delbecq, Van de Ven, &
  Gustafson, 1975). The alpha version of the product was designed in
  this phase as well.

- In the *Development Phase*, the next versions of the product were
developed and then refined. Field testing conducted with a sample of
one of the user populations, online instructors, took place and
refinements were made to the script as a result. Two instructional
designers were trained to deliver the script. A pilot study followed;
the researcher observed and collected data as the two instructional

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designers delivered the script to one online faculty member each. The script was again refined as a result of these tests.

- Product evaluation took place though summative evaluation by the same expert panel who validated the original requirements.

RESULTS

The goal of this developmental study was to test whether teaching educators a process based on instructional design theory, specifically media selection, would result in their improved ability to select learning objects for their courses. Another study goal was to test the efficacy of a process script designed for the purpose of enabling instructional designers to provide this information. The process script was developed iteratively through successive cycles of formative evaluation. It underwent two rounds of field testing by the researcher to help to improve the design of the process and format of the script. The script format was discovered to be in need of much revision, but its use resulted in the discovery of valuable online learning objects. These sessions also resulted in much creative thought on the part of both faculty subjects related to using technology in the curriculum on the level of the Bloom’s Taxonomy (1956) “synthesis” level.

Next the process script underwent two rounds of pilot testing administered by two different instructional designer subjects. Prior to administering these sessions, both instructional designers received training in use of the script. Neither subject administered the script with mastery, but one subject was much more skillful in communicating the basic instructional design processes. The faculty member who participated in the more fully realized testing session demonstrated creative
thought related to potential learning objects on the level of the Bloom taxonomy “synthesis” level while the faculty member participating in the less well-realized session did not demonstrate similar creative thought. While neither search sessions resulted in all project goals, useful learning objects were discovered in both sessions. In the cognitive walkthroughs that took place after the testing sessions, the instructional designer subjects expressed positive impressions of the process and script. They also expressed the need for additional content knowledge and changes in the format script to make it a more accessible job aid. Many of these changes were made in the next version that was sent to the Expert Panel for summative evaluation. The expert panel rated the script highly overall while acknowledging the need for further script format revisions, further pilot testing, revisions to the summative evaluation questionnaire, and streamlining of the ORSIDSTM process. Table 1 lists the requirements for ORSIDSTM validated by the expert panel, and Table 2 lists the steps that took place in the ORSIDSTM process.
Table 1: Validated Requirements for ORSIDS™

<table>
<thead>
<tr>
<th>Inputs to Process</th>
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<tbody>
<tr>
<td>Requirement #1</td>
<td>Analysis of learners</td>
</tr>
<tr>
<td>Requirement #2</td>
<td>A statement of each learning outcome</td>
</tr>
<tr>
<td>Requirement #3</td>
<td>Acknowledgement of Context including task responsibilities of instructional designer and faculty member, technological capabilities of the students’ computer equipment, students’ computer skills, and students’ online learning and multimedia skills</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Steps in the Process Script</th>
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<tbody>
<tr>
<td><strong>Learning Outcome Analysis Steps</strong></td>
<td></td>
</tr>
<tr>
<td>Requirement #4</td>
<td>Decide which learning outcome(s) (or portions of a learning outcome) should be fulfilled with an online resource</td>
</tr>
<tr>
<td>Requirement #5</td>
<td>Do a task analysis for the specified learning outcome</td>
</tr>
<tr>
<td>Requirement #6</td>
<td>Determine the learning outcome category to which the specified learning outcome belongs</td>
</tr>
<tr>
<td><strong>Research and Gather Online Resources Steps</strong></td>
<td></td>
</tr>
<tr>
<td>Requirement #7</td>
<td>Choose an instructional method</td>
</tr>
<tr>
<td>Requirement #8</td>
<td>Lecture/demonstration of multimedia formats and their uses</td>
</tr>
<tr>
<td>Requirement #9</td>
<td>Choose a media format (limited to those commonly found in online resources such as MERLOT.)</td>
</tr>
<tr>
<td>Requirement #10</td>
<td>Survey online learning resources/learning objects</td>
</tr>
<tr>
<td><strong>Learning Resource Evaluation Steps</strong></td>
<td></td>
</tr>
<tr>
<td>Requirement #11</td>
<td>Whether the resource can fulfill the learning outcome task analysis requirements</td>
</tr>
<tr>
<td>Requirement #12</td>
<td>Whether the resource has the appropriate instructional and physical attributes</td>
</tr>
<tr>
<td>Requirement #13</td>
<td>Whether, if applicable, the resource accepts student input in a manner that appropriately demonstrates his or her knowledge</td>
</tr>
<tr>
<td>Requirement #14</td>
<td>Whether the resource is appropriate for the learner</td>
</tr>
<tr>
<td>Requirement #15</td>
<td>Whether the resource is credible</td>
</tr>
</tbody>
</table>

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Table 1: Validated Requirements for ORSIDS™ (Cont.)

<table>
<thead>
<tr>
<th>Requirement #16</th>
<th>Whether the resource will have longevity as a link on the web or a request needs to be made to download it onto a server</th>
</tr>
</thead>
<tbody>
<tr>
<td>Requirement #17</td>
<td>Whether the resource places an acceptable amount of cognitive load on the learner.</td>
</tr>
<tr>
<td>Requirement #18</td>
<td>Whether the learning object is compatible with Mayer’s as well as Fleming and Levie’s principles for instructional message design.</td>
</tr>
<tr>
<td>Requirement #19</td>
<td>Whether the learning object is compatible with findings related to media attributes including some of the more recent empirical findings regarding multimedia attributes.</td>
</tr>
<tr>
<td>Requirement #20</td>
<td>Is the online learning object affordable?</td>
</tr>
<tr>
<td>Requirement #21</td>
<td>If there is a choice among learning objects, has the need to accommodate various learning styles been acknowledged with selection of the learning object that will add the most diversity to the instruction?</td>
</tr>
</tbody>
</table>

**Outputs of the Process Script**

| Requirement #22 | One or more appropriate online learning objects for each selected learning outcome for utilization in the online course |

**Process Script Format**

| Requirement #23 | The script will consist of text on paper and will include a decision tree. It will be supplemented by demonstrations on the computer for the faculty member by the instructional designer. |
| Requirement #24 | It can be copied and used for each new instructional designer/online faculty member online resource selection interaction. |
| Requirement #25 | It will consist of directions in the second person for the instructional designer, an actual script to be delivered verbatim or improvised form by the instructional designer, worksheets to be filled in and some reference materials. |
| Requirement #26 | The process script will be clear, simple, intuitive, easily navigatable, and usable |

**Reference Materials Included with the Script**

| Requirement #27 | Searching Tips |
| Requirement #28 | A Cognitive Load and Instructional Message Design Text Job Aid |
| Requirement #29 | A Multimedia Attribute Heuristic Guide |
| Requirement #30 | A Description of Learning Outcome Categories |
| Requirement #31 | Definition of Instructional Methods |
| Requirement #32 | Explanation of Task Analysis |

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Table 2: ORSIDS™ Steps

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Help the faculty member to determine which learning outcomes are good candidates for fulfillment with online learning objects.</td>
</tr>
<tr>
<td>2.</td>
<td>Guide the faculty member in doing a task analysis for the specified learning outcome.</td>
</tr>
<tr>
<td>3.</td>
<td>Help the faculty member to determine the learning outcome category to which the specified learning outcome belongs.</td>
</tr>
<tr>
<td>4.</td>
<td>Help the faculty member to determine which instructional methods may be appropriate for the learning outcome.</td>
</tr>
<tr>
<td>5.</td>
<td>Help the faculty member to focus on the instructional and physical media attributes needed by the online learning object to choose some potential media formats.</td>
</tr>
<tr>
<td>6.</td>
<td>Provide a small lecture/demonstration of various multimedia formats and methods and their uses.</td>
</tr>
<tr>
<td>7.</td>
<td>Search together for online learning objects and provide search tips to the faculty member enabling him or her to continue to search independently.</td>
</tr>
<tr>
<td>8.</td>
<td>Evaluate one or possibly two learning objects for possible use.</td>
</tr>
</tbody>
</table>

The final script was over 70 pages and is thus unsuitable for inclusion here. It is available in Dr. Cohen’s doctoral dissertation (Cohen, 2005). Figure 1 is a tracking sheet that summarizes ORSIDS™. It appears in this form in the last version of the script; its purpose is to enable the instructional designer to keep track of important elements of the process as they administer the sessions.
Figure 1: ORSIDS™ Decision Tracking Form

Validated Learning Outcome to be Fulfilled with Online Resources

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

Analyze Learning Outcome’s Fulfillment Requirements
Tasks or subtasks that need fulfillment with online learning resources

________________________________________________________________________

________________________________________________________________________

Determine Learning Outcome Categories (Check all that Apply)
Motor skills___ Attitudes___ Cognitive Strategies___ Verbal ___
Intellectual Skills__
Procedures___ Principles___ Concepts___ (Abstract or Concrete)___

Assign Instructional Methods (Check all that Apply)
Drill and Practice___ Educational game___ Simulation___
Problem Solving___ Discovery Learning___
Presentation___ Demonstration___ Dialogic___

Analyze Possible Media
Text___ Audio___ Animation___ Video___ Photos___
Drawings___ Graphics___ Diagrams___ Audio with visuals___
Text with visuals___ Audio with visuals and text___

For each task or subtask, answer the following questions related to needed media attributes:

1. What instructional attributes are needed?  2. Physical attributes?  3. How must student input be accepted?

Task___________________________________________________________________

Task___________________________________________________________________

Task___________________________________________________________________

Search for Resource
Candidates_______________________________________________
________________________________________________________________________

Resources that Passed Evaluation

________________________________________________________________________

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The study results can be classified in relation to the following elements of the study:

- The ORSIDS™ process
- The search step
- Knowledge transfer to instructional designers
- Knowledge transfer to faculty members
- The script

While the ORSIDS™ process overall proved sound, the expert panel suggested that some streamlining would make it more workable. The task analysis section proved consistently difficult during testing. The expert panel suggested the use of the task analysis to replace a candidate requirements of “conditions of learning”, but the testing indicated that it might be preferable to try to teach the original concept.

The searching step was impossible to script. Too many factors were individual to each search. Problems with searching infrastructure became apparent as a result of the testing that took place. There was no central place to locate academic learning object repositories, and a number of repositories that do exist have less than usable searching features.

Knowledge transfer of the ORSIDS™ script to the instructional designer subjects was more challenging than anticipated. Lack of payment to compensate subjects was a real study limitation. The instructional designers who participated contributed over 15 hours of unpaid work, and that amount of time proved inadequate. The instructional designer subjects were highly seasoned corporate
instructional designers. As it turned out, there were many gaps in their knowledge related to media selection, online learning object use, and the higher education context. The training and scripts provided to them were not adequate to enable their mastery. In future studies, they should be tested on their knowledge of the process and use of the script before administering the process to educators.

A positive finding about knowledge transfer and the educator subjects was how useful they found instructional design theory and how learning the ORSIDSTM process enabled their creative thinking related to the use of learning objects in their classes. Learner analysis, for example, was unfamiliar to many of the instructors and was a real revelation to them. On the downside, well-defined learning outcomes proved critical to the success of the ORSIDS process, and defining learning outcomes was particularly difficult, especially for those in the humanities.

Since the script was the product under development, it was the main element of the study. Numerous iterations of the script resulted from the study, and it changed significantly in format. Learning theory, particularly media and multimedia selection theory, was embedded in the script. At the beginning of the process, a list of candidate product requirements was developed and presented to the expert panel for validation. Many of the requirements were modeled after and captured from these media selection and multimedia selection models and procedures.
The models differ in their approaches to the following elements, and consequently decisions about the following features were made by the researcher and expert panel:

- **Use of a prescriptive model or open-ended process** - while ORSIDS™ was originally inspired by the prescriptive media selection models, it was ultimately decided that an open-ended process like ASSURE would provide more flexibility and more opportunity for educator involvement and ownership.

- **Granularity** - it was decided that the largest chunk to which a learning object could effectively correspond was the learning outcome.

- **Learning outcome type** - while Kemp’s (Kemp, 1980) outcome types were intriguing and might be explored in further testing, ultimately Gagne's learning outcomes were adopted (Gagne, Briggs, & Wager, 1992). However, one category from Romiszowski’s group (Romiszoski, 1988) was added to this scheme, the “aesthetic” learning outcome type corresponding to artistic activities.

- **Instructional methods** - these were updated to include strategies applicable to Web-based learning (Dabbagh & Babban-Ritland, 2005; Gredler, 2004; Roblyer, 2004; Smaldino, Russell, Heinich, & Molenda, 2005), including drill and practice, educational games, simulation, problem-solving, discovery learning, presentation, demonstration, and dialogic methods.
• Media - based on the media most common in available learning objects including text, audio, animation, video, photos, drawings, graphics, diagrams, audio with visuals, text with visuals, audio with visuals and text.

Figures 2 through 4 are examples of some of the materials included in the script. Their content was compiled from the literature about the media selection models. Several of the educator subjects were very enthusiastic about the contents of Figures 2 and 3. In a previous format, Figure 4 proved difficult for instructional designers to administer, and its efficacy in its present form should be tested.
Figure 2: ORSIDS™ Table of Learning Types and the Methods Most Commonly Used for Them

<table>
<thead>
<tr>
<th>Psychomotor</th>
<th>Attitudes</th>
<th>Cognitive</th>
<th>Verbal</th>
<th>Intellectual</th>
<th>Miscellaneous (aesthetic)</th>
</tr>
</thead>
<tbody>
<tr>
<td>simulation</td>
<td>simulation</td>
<td>simulation</td>
<td>drill-and-practice</td>
<td>simulation</td>
<td>presentation</td>
</tr>
<tr>
<td>presentation</td>
<td>presentation</td>
<td>presentation</td>
<td>presentation</td>
<td>presentation</td>
<td>demonstration</td>
</tr>
<tr>
<td>demonstration</td>
<td>demonstration</td>
<td>demonstration</td>
<td>games</td>
<td>demonstration</td>
<td>discovery</td>
</tr>
<tr>
<td>case study</td>
<td>case study</td>
<td>case study</td>
<td>case study</td>
<td>case study</td>
<td></td>
</tr>
<tr>
<td>role play</td>
<td>role play</td>
<td>role play</td>
<td>role play</td>
<td>role play</td>
<td></td>
</tr>
<tr>
<td></td>
<td>dialogic</td>
<td></td>
<td>dialogic</td>
<td>dialogic</td>
<td></td>
</tr>
<tr>
<td></td>
<td>problem solving</td>
<td></td>
<td>problem solving</td>
<td>discovery</td>
<td>games</td>
</tr>
</tbody>
</table>

*Note: Visuals referred to in this table generally consist of photos, simple animation or line drawings with arrows.

Figure 3: ORSIDS™ Table of Learning Types and the Media Most Commonly Used for Them has

<table>
<thead>
<tr>
<th></th>
<th>Audio &amp; Visua</th>
<th>Audio &amp; Visua</th>
<th>Audio &amp; Visua</th>
</tr>
</thead>
<tbody>
<tr>
<td>Psychomotor</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Attitudes</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Cognitive</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Verbal</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Intellectual</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Miscellaneous (aesthetic)</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>Related Learning Outcome Issues</th>
<th>Text</th>
<th>Audio</th>
<th>Animation</th>
<th>Video</th>
<th>Photos</th>
<th>Drawings</th>
<th>Related Media Issues</th>
</tr>
</thead>
<tbody>
<tr>
<td>For memory support, leave information to be memorized on screen as text.</td>
<td>Make sure that audio segments can be replayed and replayed at reasonable intervals; Some students have a hard time learning from audio.</td>
<td>Animations should be assessed carefully for potential cognitive load problems.</td>
<td>Video can be effectively replaced online with still photos, line drawings with arrows &amp; simple animations supported by audio; assess video applications individually for problems.</td>
<td>A multi-image presentation using 2 or more simultaneous photos to compare visual phenomena can be effective for different purposes.</td>
<td>Can be better than photos because detail can be minimized or maximized through callouts.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Verbal Learning | Can be most efficient medium for good readers. | | | | | Requires opportunity for practice and feedback. | |
|-----------------|-------------------------------------------------|------------------|----------------|-------------------|------------------|----------------------|
| Attitudes Learning | Compelling text can teach attitudes. | Use of the voice of an admired, recognizable role model can be effective as can background music, sound effects & narration. | Dramatic reenactments can change attitudes. | Can promote cultural understanding through showing other ways of life. | Photos of people can change attitudes. | |

<table>
<thead>
<tr>
<th>Psychomotor Learning</th>
<th>Can guide learning of motor skills.</th>
<th>Can display physical skills and allow repeated viewing and practice.</th>
<th></th>
<th>Can show position of people and things in motion.</th>
<th></th>
<th></th>
</tr>
</thead>
</table>

© Dr. Deborah Cohen, 2005
<table>
<thead>
<tr>
<th></th>
<th>Text</th>
<th>Audio</th>
<th>Animation</th>
<th>Video</th>
<th>Photos</th>
<th>Drawings</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Intellectual Learning</strong></td>
<td>Can teach concepts and rules and fulfill other intellectual learning outcomes</td>
<td>Can guide learning of intellectual skills</td>
<td>Can be used to simplify rapid and complex processes and to manipulate time &amp; space</td>
<td>Can portray procedures and case studies</td>
<td>Can be used to teach processes.</td>
<td>Can display facts related to forms, equipment, computer screens &amp; information invisible to the eye,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dramatic audio segments can be used to introduce problems</td>
<td></td>
<td>Can show things too dangerous to see otherwise</td>
<td>Can point out critical differences between objects &amp; exaggerate differences</td>
<td>Can show principles of operation of objects with working parts enclosed</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Can teach recognition and discrimination of audio stimuli</td>
<td></td>
<td>Teaches recognition &amp; discrimination of relevant motion stimuli, teaches rules, principles, &amp; models performance especially with human interaction</td>
<td>Can identify people, places &amp; things</td>
<td>Can display critical differences among objects</td>
</tr>
<tr>
<td><strong>Aesthetic (miscellaneous) Learning</strong></td>
<td>Can be used for stories, poems, &amp; oral histories</td>
<td>Can be used for stories, poems, &amp; oral histories</td>
<td>Can present artistic performances and storytelling and manipulate space &amp; time</td>
<td>Can present artistic performances and storytelling and manipulate space &amp; time</td>
<td>Can present artistic performances and storytelling and manipulate space &amp; time</td>
<td>Can present artistic performances and storytelling and manipulate space &amp; time</td>
</tr>
<tr>
<td><strong>Related Learning Outcome Issues</strong></td>
<td>For memory support, leave information to be memorized on screen as text.</td>
<td>Make sure that audio segments can be replayed and replayed at reasonable intervals</td>
<td>Animations should be assessed carefully for potential cognitive load problems.</td>
<td>Video can be replaced online with still photos, line drawings with arrows &amp; simple animations supported by audio; assess online video applications individually for problems</td>
<td>A multi-image presentation using 2 or more simultaneous photos to compare visual phenomena can be effective</td>
<td>Can be better than photos because detail can be minimized or maximized through callouts.</td>
</tr>
</tbody>
</table>

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(For Other Selected Media Types)

<table>
<thead>
<tr>
<th></th>
<th>Graphics</th>
<th>Diagrams</th>
<th>Audio with Visuals</th>
<th>Text with Visuals</th>
<th>Audio with Visuals &amp; Text</th>
<th>Related Media Issues</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Psychomotor Learning</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Drawings and photos can be sequenced to show steps in psychomotor skills.</td>
<td></td>
</tr>
<tr>
<td><strong>Attitudes Learning</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Verbal Learning</strong></td>
<td>Depicts concepts, phenomena, trends</td>
<td>Multi-Image diagram could show schematic next to actual components</td>
<td></td>
<td></td>
<td>Animation with audio can replace video.</td>
<td>Provide opportunity for practice and feedback</td>
</tr>
<tr>
<td><strong>Intellectual Learning</strong></td>
<td>Depicts processes, concepts, rules, phenomena, trends, interrelationships</td>
<td>Good for concepts, rules &amp; can illustrate relationships. Multi-Image diagram could show schematic next to actual components</td>
<td>Diagrams good</td>
<td></td>
<td>Animation with audio can replace video</td>
<td></td>
</tr>
<tr>
<td><strong>Related Learning Outcome Issues</strong></td>
<td>Graphics = graphs and charts. Graphs are a visual rep. of numerical data, charts a visual rep. of abstract concepts like org charts and timelines</td>
<td>Diagrams = visuals aiming at a clear depiction of an object or characteristics of an object, such as schematics, or flow diagrams</td>
<td></td>
<td></td>
<td>Animation with audio can replace video</td>
<td></td>
</tr>
</tbody>
</table>

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While the media selection literature provides a strong foundation for the selection of learning objects, there are limitations to the content in the media selection material upon which ORSIDS™ was based that it would useful to rectify in the future. The scientific rigor behind the reported media attribute findings is hard to determine. For the most part, the authors did not identify the research sources for the conclusions that they drew related to media attributes. Where the research sources were identified, details of the study's experimental features and discussion of their methodological validity were rarely presented. Reiser and Gagne (1983) posed as an unresolved research question whether they had identified the correct media to fulfill the various learning outcomes, indicating that these issues were not answered to their full satisfaction at the time they completed their study. Additionally, these attributes of the media were identified prior to their delivery via computer, so additional testing is needed for scientifically validated confirmation of media and multimedia attributes.

FUTURE TRENDS

A number of future trends were identified through this study. ORSIDS™ was ultimately validated. If the study is continued, the product can fulfill the promise that the expert panel identified. What is learned about effective knowledge transfer techniques in the learning object selection domain can then be applied to other instructional designer/educator technology integration needs. The necessity for the establishment of the pedagogical underpinnings for learning object systems is becoming clear, and instructional designers hopefully will increasingly contribute their energies to such efforts. The study also made apparent the need
for the instructional design field to expand into Communication Studies to explore interpersonal communications between instructional designers and the subject matter experts with whom they work, including educators in the higher educational arena.

CONCLUSION

Learning objects can provide a valuable addition to online classes, making it possible to teach concepts that would otherwise be inaccessible. This study demonstrated that through learning the theories of instructional design, particularly media selection theory, through the ORSIDS™ process, educators can be quickly equipped to think creatively about the learning objects that might be suitable for their online classes and be provided with the means to search for and evaluate learning objects available online.
REFERENCES


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