The Conceptualization, Utilization, Benefits and Adoption of Learning Objects

Sunha Kim

Dissertation submitted to the faculty of the Virginia Polytechnic Institute and State University in partial fulfillment of the requirements for the degree of

Doctor of Philosophy
In
Curriculum and Instruction

Barbara Lockee, Chair
John Burton
Ken Potter
Jennifer Brill

December 7, 2009
Blacksburg, Virginia

The Conceptualization, Utilization, Benefits and Adoption of Learning Objects

Sunha Kim

ABSTRACT

Learning objects have received attention because of their potential to improve current methods of teaching and learning. Despite perceived importance, there has been lack of studies that examine the use of learning objects across various contexts. In response, this study examined the actual use of learning objects and their perceptions among Instructional Design and Technology (IDT) practitioners in U.S. This study was based on the data from 191 IDT practitioners from various sectors, including higher education, business, government, and K-12.

The study results contribute to the body of knowledge on learning objects in terms of four areas: conceptualization, utilization, benefits, and adoption. First, the study results should allay the concern that the conceptualization of learning objects focuses too much on technical aspects. IDT practitioners emphasized both technical and learning aspects in conceptualizing learning objects. In conclusion, the present study laid the foundation for a working definition of learning objects.

Second, the study showed that IDT practitioners were utilizing learning objects to empower learners to have control over their own learning. The current study identified design strategies that IDT practitioners were frequently using. The most frequently utilized strategy was the provision of concrete, authentic examples and problems. Along with design strategies, this study identified the frequently adopted granularity levels: assets, combined media, one complete instructional unit, lesson or module, and course. Combined media, which consists of content and optional media, was the most frequently utilized granularity level of the five levels. The study provided empirical data to help determine formal design strategies and optimal granularity levels in utilizing learning objects based on the frequent use among IDT practitioners.

Third, this study filled the research gap on the benefits of learning objects from an IDT perspective. Study results showed that IDT practitioners were positive about the overall benefits for the ID process, along with reusability and the support for the motivation and interactivity features. However, they were less convinced of the time and cost savings. Generally, IDT practitioners were satisfied with the benefits of learning objects.

Fourth, the present study improved the understanding of the adoption status of learning objects. Currently, many of the participants' organizations were adopting or exploring the implementation of learning objects. The adoption of learning objects has a promising future, as IDT practitioners were positive about their organizations' intentions to use learning objects in the future. At the individual level, IDT practitioners were found to use learning objects for their professional role and across various projects. As an adoption factor, IDT practitioners showed the positive reactions to learning objects' perceived usefulness.

Acknowledgements

First of all, I would like to thank God, who has provided me with the guidance and strength to help me complete this dissertation. I want to recognize the support and love of my family: my father, Kwanjoong Kim; my mother, Youngsook Song; my brother, Sunil Kim; my sister-in-law, Jeonghyun Lee; and my nephews, Eunkang and Eunchan. In particular, my parents' trust in my potential and their constant prayers have been a great source of inspiration. Along with my family back in Korea, I would like to thank my Christian friends here at Virginia Tech, Dr. Don McKeon and Robert Howe, who have edited my dissertation and prayed for its successful completion.

I want to thank my advisor, Dr. Barbara Lockee, and my other committee members, Dr. John K. Burton, Dr. Ken Potter, and Dr. Jennifer M. Brill. Their clear guidance, patience, and support have been so helpful throughout the whole dissertation process. Thanks to all the opportunities that my advisor and other committee members have offered through the Instructional Design and Technology (IDT) program at Virginia Tech, I have grown so much as a person and a learner.

Lastly, I would like to thank the IDT community. While IDT professionals do not know me in person, many of them were willing to participate in my study just because I am a member of the IDT community. While it is said that the data collection process is one of the most difficult processes in the dissertation, IDT professionals' willingness to help made the data collection process the most exciting part of my whole dissertation.

Table of Contents

List of Tables

Chapter One: Introduction

The purpose of the present study was to explore the use and perceptions of learning objects among IDT practitioners across varying organizations. To serve this purpose, the present study conducted a literature review on various topics related to learning objects and identified the conceptualization, utilization, benefits and adoption of learning objects as topics of interest. In effort to investigate these identified topics, the present study developed a survey instrument. The survey was completed by 191 IDT practitioners from multiple organizations across higher education, business, government, and K-12. Using descriptive statistics, the survey data was analyzed to investigate the use and perceptions of learning objects. The study results showed that the current conceptualization focused on the combination of learning and technical aspects. IDT practitioners were found to utilize various instructional strategies and five granularity levels (assets, combined media, unit, lesson and course). The study revealed the overall perceived benefits of learning objects among IDT practitioners. The study reported the current and future adoption status of learning objects at both individual and organizational levels. In conclusion, the present study increased the understanding of important topics of learning objects and provided suggestions for future research.

Overview

Learning objects have received a lot of attention because of their potential to improve the current way of teaching and learning (Wiley, 2002). Many studies have been conducted to empirically examine the potential of learning objects, and the results of these studies seem to demonstrate the benefits of learning objects. For example, some studies have proven the effects of learning objects on students' achievement (Bradley & Boyle, 2004; Kay, 2007; Lim, Lee, &

Richards, 2006). Also, it is reported that learning objects have helped to reduce the cost and time required for course development (Dodds & Fletcher, 2004; Wang & Hsu, 2006).

However, other educators were not positive about the use of learning objects in education. According to Wiley (2002), many educators criticize learning objects by arguing that learning objects are "learning theory agnostic" (p.16). Regarding the time and cost savings for course development, studies showed mixed results on learning objects' effectiveness (Christiansen & Anderson, 2004; Kay & Knaack, 2008a).

In order to draw conclusions on such mixed reactions to the use of learning objects, there is the need for empirical study to investigate the use and potential of learning objects across multiple contexts. A review of studies on learning objects showed that existing studies have been conducted in the context of a single setting, and there is a lack of research to explore the actual use and potential of learning objects across various contexts. For example, most studies were conducted within single organizations (Bradley & Boyle, 2004; Cook, Holley, & Andrew, 2007; Nugent, Soh, & Samal, 2006; South & Monson, 2002; Wang & Hsu, 2006) or in individual K-12 classrooms (Kay & Knaack, 2007a).

In response, the present study attempted to explore the actual use of learning objects and their perceptions across various organizations in the United States, based on data from actual users of learning objects. Out of users of learning objects, the present study focused on practitioners in the Instructional Design and Technology (IDT) field. The study results are expected to enrich the body of knowledge on learning objects, as the present study addresses broader perspectives by involving instructional designers and developers who not only reuse existing learning objects but also create new learning objects. The existing studies reveal limited perspectives from students and teachers who use existing learning objects but do not modify and

create learning objects (Bradley & Boyle, 2004; Cochrane 2005; Kay, 2007; McCormick & Li, 2006; Recker, 2007).

To investigate the actual use and perceptions of learning objects, the present study included the concept, utilization, benefits, and adoption status of learning objects as topics of interests. The research questions of the present study are as follows:

(1) What is the current conceptualization of learning objects?

(2) How are learning objects currently being used across varying organizations? What sizes of learning objects are IDT practitioners using? What design strategies are IDT practitioners adopting when using learning objects?

(3) What are the perceived benefits of learning objects in terms of their support for instructional design and development?

(4) What is the adoption status of learning objects across varying settings? How do adoption factors affect the current use of learning objects?

Needs for the Study

The Conceptualization of Learning Objects

Researchers have expressed concern over the conceptualization of the learning objects since their initial use. This concern was justified, as in the early stage the concept of learning objects was founded on technical features and functions; the emphasis was on reusability, with no consideration of learning aspects (Parrish, 2004). In response to criticism for an absent theoretical foundation, a great deal of effort has been made to define learning objects from a learning perspective (Bradley & Boyle, 2004; Jonassen & Churchill, 2004; Kay & Knaack, 2007a; Wiley, 2002).

Despite the effort to construct a definition of learning objects that incorporates both learning and technical aspects, there is no consensus on a workable definition of learning objects (Fletcher, Tobias, & Wisher, 2007). Furthermore, some researchers (Yahya & Yusoff, 2008) maintain that there is still a misunderstanding in the concept of learning objects, which prevents learning objects from being effectively applied in education. In response to the confusion regarding the conceptualization of learning objects, the present study attempted to investigate whether researchers' concerns are valid by exploring how learning objects were conceptualized among actual users of learning objects.

To explore the current conceptualization of learning objects, the present study investigated whether the focus of the current conceptualization involves technical aspects, learning aspects, or a combination of both. Furthermore, through an analysis of current definitions, the present study identified three components that define learning objects: digital resources, reusability characteristics, and educational purposes. The present study examined the perceived importance of these three components and explored other additional components in defining learning objects.

The Utilization of Learning Objects

A review of current literature shows three themes in the utilization of learning objects: as a support in automating the instructional designing process (ADL, 2004; IEEE, 2002; Merrill, 2002); as a support for instructional designers and developers to design and develop instruction (Muzio, Heins, & Mundell, 2002; Recker, Dorward, & Nelson, 2004); and as a tool to empower learners to control their own learning (Bannan-Ritland, Dabbagh, & Murphy, 2002; Collis & Strijker, 2001; Duval, Hodgins, Rehak & Robson, 2004; McGee, 2006; Tan, Aris, & Abu, 2006). Based on these three themes, the present study explored how IDT practitioners are currently utilizing learning objects, thereby filling in the research gap of examining the actual utilization of learning objects across various contexts.

Design Strategies. As an effort to find an effective way to utilize learning objects for learning, researchers have used various design strategies to develop learning objects (Bradley & Boyle, 2004; Cochrane, 2005; Farrell & Carr, 2007; Krauss & Ally, 2005; Lim et al., 2006; Nugent et al., 2006). While individual studies introduced their own design strategies, there have been no agreed-upon formal instructional design strategies for using learning objects. Furthermore, there is a lack of research exploring how learning theories or instructional strategies have been utilized across various settings, as most of the studies have been conducted in one single organization.

Therefore, the present study aimed to contribute to the knowledge of the current status of instructional strategies for learning objects, with the expectation that the study results would be a basis for the development of formal instructional strategies for learning objects. Based on the current literature, the present study identified the learning strategies and explored what strategies were adopted by IDT practitioners.

Granularity Levels. One of the most predominant issues in applying learning objects in education is the size of learning objects, also known as the granularity level (Wiley, 2002). A review of the literature shows a lack of research empirically exploring how different granularity levels were utilized across various organizations. By synthesizing widely used granularity levels (ADL, 2004; Bannan-Ritland, Dabbagh, & Murphy, 2002; Cisco, 2003), the present study identified five granularity levels: asset, combined media, one complete instructional unit, lesson or module, and course. To provide knowledge of the granularity levels across various organizations, the present study investigated what granularity levels were currently being utilized.

Many researchers have tried to define the optimal granularity levels of learning objects (Kay, 2007; Nugent et al., 2006). However, there has been no consensus on the optimal granularity levels, as different levels have different benefits. For example, while a smaller unit size is more suitable for reuse in different contexts, a larger unit size can be more effective for meaningful learning (Griffiths, 2007; Wiley, Gibbons, & Recker, 2000). To provide some preliminary data in order to determine the optimal granularity level, the present study investigated what granularity level was most frequently utilized and what factors were related to the use of granularity levels. In addition, the present study measured the consistency of the use of granularity levels across projects.

The Benefits of Learning Objects

To examine the benefits of learning objects, some studies have explored the perceived benefits in terms of students' learning by surveying students and their teachers, respectively (Kay, 2007; Kay & Knaack, 2007a; Kay & Knaack, 2008b). Beyond students' learning benefits, other studies have reviewed teachers' perspectives on benefits to their own teaching practice

(McCormick & Li, 2006; Recker et al., 2006). While these studies reported positive perceptions on the benefits of learning objects for students and teachers, the current literature review revealed the need for future study to address broader perspectives by involving instructional designers and developers in addition to students and teachers. While many efforts have been made to support the instructional design and development process (Bannan-Ritland, Dabbagh, & Murphy, 2002; Hsin-Yih, Shang-Hsien, & Yu-Hur, 2004; Kang, Lim, & Kim, 2004; Lukasiak et al., 2005), there is a lack of research examining learning objects' perceived benefits in aiding this process from instructional designers' and developers' perspectives. In response, the present study explored the perceived benefits of learning objects in supporting the instructional design and development process, with specific attention to reusability, development time and cost, and support for interactivity and motivation.

Reusability. The reusability of learning objects is one of the key characteristics that facilitates the instructional design and development process by making the reuse of existing learning resources possible (Nugent et al., 2006; Parrish, 2004). The review of current literature showed that learning objects' reusability characteristics were examined mostly through the perspectives of teachers who were involved in reusing learning objects as they were, without much modification (Cochrane, 2007; McCormick & Li, 2006; Nesbit, Belfer, & Vargo, 2002). Furthermore, studies showed mixed results on the reusability benefits. In response, the present study aimed to provide knowledge on the perceived benefits of learning objects' reusability characteristics from a broader perspective by engaging IDT practitioners who have been designing, developing, and delivering instruction through learning objects.

Development Time and Cost. One of the potential benefits of utilizing learning objects for the instructional design process is to decrease the time and cost it takes to design and develop

new courses by efficiently reaching a larger audience (Parrish, 2004; Schatz, 2005). Studies were engaged in examining and improving the time and cost effectiveness of learning objects (Christiansen & Anderson, 2004; Wang & Hsu, 2006). However, the results were mixed and further studies are needed to draw a conclusion by incorporating broader views, as the current studies have been conducted in a single setting. Therefore, the present study investigated the perceived benefits of learning objects on the time and cost in designing, developing, and delivering learning object-based instruction.

Support for Motivation and Interactivity. Many attempts have been made to develop pedagogically-rich learning objects. For example, learning object systems have been developed with pedagogical aids to guide the instructional design and development process (Kang et al., 2004; Lukasiak et al., 2004; Wang & Hsu, 2006). While many efforts have been made to utilize learning objects to support the instructional design process, there is a lack of research examining how learning objects are perceived to support the process of designing and developing meaningful learning.

Out of various instructional strategies for meaningful learning, the features to support motivation and interactivity have been embedded in the design and development of learning objects. Studies showed that learning objects successfully motivated students and provided interactivity features (Kay, 2007; Kay & Knaack, 2007b; McCormick & Li, 2006). However, other studies revealed that learning objects were not effective at promoting interactions, nor were they adaptable; however, they were effective to motivate students (Krauss & Ally, 2005). Considering the importance and inconclusive results in terms of interaction and motivation features of learning objects, further study is needed to explore learning objects' perceived benefits in supporting the design and development of motivation and interactivity features. In

response, the present study explored the perceived benefits of learning objects in this regard based on IDT practitioners from various contexts.

The Adoption Status of Learning Objects

A review of the literature shows a lack of research examining the adoption status of learning objects. Moreover, the review of the limited research that deals with the adoption of learning objects revealed the need for a study based on a theoretical foundation, a study that also examines the adoption of learning objects across various organizations. For example, Schibeci et al. (2008) attempted to identify factors that impact the broader adoption of learning objects as a part of their study, but did not use a specific theoretical model to guide their study. On the other hand, based on the institutional change model, Cook, Holley, and Andrew (2007) investigated the practice and the impact of learning objects. However, as their study is from one specific higher-ed institution, it failed to report the current adoption status across various organizations in the U.S.

To fill the research gap identified above, the present study explored the extent to which learning objects have been adopted across various organizations based on the Diffusion of Innovations theory (Rogers, 2003). While Rogers' theory has been used as one of the most popular models in the area of technology diffusion and adoption (Sherry & Gibson, 2002), little research has been done in the area of learning objects. As the implementation of learning objects was determined at the organizational level because of the infrastructure needed for the implementation, the present study explored the current adoption status of learning objects at the organizational level. Beyond the current implementation status, the present study attempted to predict the future use of learning objects by measuring intentions to use and to increase their use.

As with the adoption status at the organizational level, the present study examined the adoption status at the individual level. The individual adoption status was explored in terms of actual and project-based use. IDT practitioners revealed how frequently they were using learning objects for their professional role and for their own projects. The results of adoption status at both individual and organizational levels are expected to promote a comprehensive understanding of learning objects' overall adoption status.

Finally, the present study identified perceived usefulness and perceived ease of use as factors of interest grounded on the positive relation between these factors and the adoption of new technologies (Davis, 1989; Davis, Bagozzi, & Warshaw, 1989; Lau & Woods, 2008). The present study explored how these adoption factors influenced the current use of learning objects among IDT practitioners. The study results potentially inform the way to promote learning objects' adoption for future educational use.

Chapter Two: Literature Review

The Conceptualization of Learning Objects

Researchers have expressed concern over the conceptualization of learning objects that focuses on technical features and functions. This concern has been justified on the grounds that, at an early stage, the concept of learning objects was founded on technical terms (Parrish, 2004). In response to the criticism for the lack of a theoretical foundation, a great deal of effort has been made to define learning objects from a learning perspective (Bradley & Boyle, 2004; Jonassen & Churchill, 2004; Kay & Knaack, 2007a; Wiley, 2002). Despite major efforts to construct a definition of learning objects that incorporates both learning and technical aspects, there is no consensus on a workable definition of learning objects (Fletcher, Tobias, & Wisher, 2007). Furthermore, even now, current conceptualizations have been the focus of concern among researchers as some of the conceptualizations still reflect a technical focus (Northrup, Rasmussen, & Dawson, 2004).

The Evolution of the Conceptualization of Learning Objects

Technical Aspects. Some definitions show the focus on technical aspects of learning objects without any consideration of what constitutes learning at all. For example, the Educational Objects Economy (AOE) project, supported by NSF, defines learning objects as Java Applets (Ip & Morrison, 2001). Asymetix, a computer-based training vendor, defines learning objects as "pre-scripted elements that simplify programming" as cited by Wiley (2002, p5). Similarly, by focusing on reusability characteristics without any consideration of learning, Northrup, Rasmussen, and Dawson (2004) define learning objects as "*a digital resource that is flexible enough to be reused in multiple locations*" (p.187).

Unlike these definitions, the IEEE (2002) construes "learning" as "any entity, digital or non-digital, which can be used, re-used or referenced during technology supported learning"

(p.6). However, although the IEEE's definition makes reference to "learning," it does not define the term intrinsically. Compared with the IEEE's definition, Quinn (2000) emphasizes the acquisition of educational "chunks" for some pedagogical purpose in the definition. However, just like the IEEE's statement, Quinn's definition elaborates on technical aspects such as on an Object Oriented Programming (OOP) model, self-containment, and independence. Because of the lack of a theoretical background, many educators criticize the notion by objecting that learning objects are "learning theory agnostic" (Wiley, 2002, p. 17). In response to this criticism, researchers have been seeking ways to integrate learning theories into the application of learning objects.

The Combination of Technical and Learning Aspects. Different from definitions with more technical focus, some definitions of learning objects include learning aspects more purposefully. Wiley defines learning objects as "*any digital resource that can be reused to support learning*" (2002, p.6). He emphasizes that the purpose of learning objects is to support learning and does not refer to other technical aspects except the reusability characteristics. Similarly, by objecting to the definition based on OOP approach, Sosteric and Hesemeier (2002) provide their own definition as *"a digital file (image, movie, etc.,) intended to be used for pedagogical purposes, which includes, either internally or via association, suggestions on the appropriate context within which to utilize the object*" (p.4). In specifying pedagogical purposes, they emphasize their utility in instructional situations.

Some researchers sought to identify instructional components for the definition. By clearly mentioning the educational purpose, Mavrommatis (2008) identifies instructional objectives or concepts as important components of the definition. On the same note, with the focus on the learning aim, Laverde, Cifuentes, and Rodríguez (2007) identify content,

instructional activities, and context as essential instructional components. Similar to instructional components in these definitions, the Cisco's (2003) definition includes objectives and content as instructional components. In addition to these two components, Cisco definition identifies practices and assessment.

More Emphasis on Learning Aspects. Beyond the combination of technical and learning aspects, researchers have attempted to emphasize more of the theoretical background in their conceptualization of learning objects. Through their design, learning objects reflect various learning orientations including constructivist, behaviorism, and cognitivism. For example, Churchill defines a learning object as "a representation designed to afford uses in different educational contexts" (2007, p.484). But he does not clearly address technical aspects even though he remarks that design indicates that the origin of the notion comes from educational use. He also refers to the underlying learning principles which guide the design of learning objects in such a way as to utilize content analysis, instructional multimedia, interface design guidelines, learning theories, graphic design, etc. Furthermore, Churchill emphasizes the integration of existing instructional design models into the design of learning objects.

In addition, Bradley and Boyle (2004, p.372) define learning objects as "reusable micro-contexts" by suggesting that the definition implies that learning objects should be pedagogically rich. Furthermore, based on constructivist beliefs, they emphasize that learning objects need to promote interaction and active cognition processes. Also, by stating learning objects as contexts, this definition attempts to respond to the criticism made against the de-contextualization of learning objects.

Similarly, Parrish defines learning objects as a process or strategy by stating that learning objects refer to "*Object-Oriented Instructional Design (OOID), the strategy for designing digital*

learning content and activities as discrete, addressable, and adaptable units, in order to achieve fine-grained accessibility and improved reusability" (2004, p. 52). Parrish argues that his definition is different from the previous ones, especially Wiley's, as it treats a learning object as a process or strategy, not as an artifact or some kind of concrete object.

Common Themes in Definitions of the Current Literature

Through further analysis of the existing literature on definitions of learning objects, three themes were identified. First, what are learning objects? Simply put, they are digital resources. Second, what is the most distinguishing characteristic of learning objects? They are reusable. Third, what is the primary purpose of learning objects? They have an educational purpose. Therefore, by combining these three themes, this study is based on the following definition: "*learning objects* are reusable digital resources for educational purposes."

What It Is: Digital Resource

A review of various definitions from the current literature shows that learning objects are digital resources. As mentioned earlier, although the IEEE (2002) includes non-digital resources in its definition of learning objects, following Wiley (2002), non-digital resources are excluded from the concept of learning objects. The word "digital" is one of the most frequently found words in the list of current definitions (Laverde, et al., 2007; Cochrane, 2005; IEEE, 2002; Koper, 2003; Mavrommatis, 2008; Northrup, et al., 2004; Sosteric & Hesemeier, 2002; Wiley, 2002). Also, many define learning objects as resources (Northrup, et al., 2004; Wiley, 2002), entities (Laverde, et al., 2007; IEEE, 2002) or files (Sosteric & Hesemeier, 2002). Some definitions did not include digital resources are as their definitions are based on specific learning theories (Bradley & Boyle, 2004; Churchill, 2007; Parrish, 2004), but most of the studies include "digital resources" in their respective definitions.

Distinguishing Characteristic: Reusable

The Advanced Distributed Learning (ADL, 2004) Initiative of the U.S. Department of Defense characterizes learning objects in terms of reusability, accessibility, interoperability, and durability. "Reusability" refers to the flexibility of learning objects to be used in multiple contexts and applications. "Accessibility" implies that learning objects are available to users from different locations. "Interoperability" means that learning objects are operable across different operating systems and platforms. "Durability" indicates that learning objects can withstand technical changes.

Out of these four characteristics, many of the prominent definitions incorporate the notion of "reusability" (Laverde, et al., 2007; Cisco, 2003; IEEE, 2002; Mavrommatis, 2008; Northrup, et al., 2004; Wiley, 2002). While Koper (2003) uses a different word "reproducible" in his definition, he too means "reusable," since he adds "…made available for others to use." In exploring the meaning of "reusability," some researchers have focused on different educational settings (Bradley & Boyle, 2004; Churchill, 2007), while others have focused on different applications by specifying "metadata", which enables the reusability (Laverde, et al., 2007).

The Purpose: Educational Purpose

Except for a few definitions (Ip & Morrison, 2001; Northrup, et al., 2004), most of definitions include learning aspects by including terms such as "learning", "instructional," "pedagogical" or "educational" (Laverde, et al., 2007; Cisco, 2003; IEEE, 2002; Koper, 2003; Mavrommatis, 2008; Sosteric & Hesemeier, 2002; Wiley, 2002). Many of these definitions clearly state that the purpose of learning objects is to support learning with the attempt to achieve a learning objective. Moreover, some definitions strive to specify the components of learning objects by emphasizing learning aspects. For example, Cisco (2003) includes contents, practice

activities, and learning objectives, while Laverde, Cifuentes, and Rodríguez (2007) specify contents, activities, and context. The table below shows the list of definitions from the current literature review. Four components – digital, resource, reusable and educational – are marked differently.

Table 1. Definitions of Learning Objects

The definitions with technical focus
- Java Applets (Ip & Morrison, 2001)
- Pre-scripted elements that simplify programming
- any entity, **digita**l or non-digital, which can be used, ***re-used*** or referenced during technology supported **learning** (IEEE, 2002)
- a **digita**l resource that is flexible enough to be ***reused*** in multiple locations (Northrup, et al., 2004)
The definitions which combine technical and learning aspects of learning objects
- Any **digital** resource that can be ***reused*** to support **learning** (Wiley, 2002)
- Any **digital**, ***reproducible*** and addressable resource used to perform learning activities or learning support activities, made available for others to use (Koper, 2003)
- *a **digital** file (image, movie, etc.,) intended to be used for **pedagogical** purposes, which includes, either internally or via association, suggestions on the appropriate context within which to utilize the object* (Sosteric & Hesemeier, 2002)
- learning objects are based on a single **learning objective** built from a collection of static or interactive **contents** and instructional **practice activities** (Cisco, 2003)
- a standalone, ***reusable***, **digital** resource that aims at teaching one or more instructional objectives or concepts (Mavrommatis, 2008)
- Interactive **digital** resources illustrating one or a few interrelated concepts (Cochrane, 2005)
- a **digital,** self-contained, ***reusable*** entity with a clear learning aim that contains at least three internal changing components: content, instructional activities, and context elements. As a complement, the learning object should have an external component of information which helps its identification, storage, and recovery: the metadata (Laverde, et al., 2007)
The definitions with theoretical focus
- a representation designed to afford *uses in **different** **educational contexts*** (Churchill, 2007)
- ***reusable*** micro-**contexts** (Bradley & Boyle, 2004)
- Object-Oriented **Instructional** Design (Parrish, 2004)

Summary

Despite efforts to define learning objects, there has been no consensus on a workable definition of learning objects among researchers (Fletcher, et al., 2007). Researchers have expressed the need for a broad acceptance of concepts related to learning objects as the common ground to further discuss and facilitate the application of learning objects for learning and teaching practice (Churchill, 2008). As a way to build a common understanding of concepts of learning objects, the present study explores how learning objects are currently conceptualized

among IDT practitioners. In particular, the present study explores whether the focus of the current conceptualization involves technical aspects, learning aspects, or a combination of both. Furthermore, based on an analysis on current definitions, the present study identifies three components of defining learning objects: digital resources, reusability characteristics, and educational purposes.

The Utilization of Learning Objects

A review of the literature has shown three themes of the utilization of learning objects to support the automated instructional design process, to aid instructional designers, developers and instructors, and to empower learners to control their own learning. The present study focuses on investigating how learning objects are utilized to aid instructional designers and developers. Specifically, the study explores the design strategies and granularity. Based on the current literature, the study identifies specific learning strategies based on behaviorism, cognitivism, and constructivism. Also, five granularity levels are identified based on current practice, and advantages and disadvantages associated with each of these levels are investigated. Furthermore, the study identifies certain factors to be considered when selecting the granularity levels.

Three Themes of Utilization of Learning Objects

Automated Instructional Design. The focus on automated instructional design is revealed by both the IEEE's and the ADL's statements of the purpose of learning objects. According to IEEE (2002), the purpose of learning objects' metadata is to automatically build individualized instruction for each learner by the system. Similarly, ADL (2004) emphasizes supporting artificial intelligence, which constitutes a lesson for individual learners by searching learning objects which will meet individual learning needs. Also, Merrill (2002) discusses the potential of

learning objects to support intelligent educational systems by utilizing advanced technical features of learning objects.

Based on the potential of learning objects, existing automated instructional design systems have attempted to incorporate learning objects into their systems. According to Spector and Ohrazda (2003), the Guided Approach to ID Advising provides a sample case, developed by experienced instructional designers, for novice instructional designers as a good example. The studies were conducted to build these sample cases using learning objects. Similarly, Generic Tutoring Environment (Spector & Ohrazda, 2003), which supports intelligent tutoring systems, has attempted to utilize an object-based network to upgrade its existing instructional network. The integration of learning objects into current instructional systems for automation is expected to make systems more efficient by reusing existing components (Spector & Ohrazda, 2003). However, in response to this movement to utilize learning objects for automation, researchers have been concerned that this trend would aggravate the human isolation issue by allowing learners to interact solely with the machine (Wiley, 2003).

Instructional Designers, Developers and Instructors. Another trend of utilizing learning objects has been to aid instructional designers, developers, and instructors. A good example of the utilization of learning objects in an organization could be found in the Centre for Economic Development and Applied Research (CEDAR) at Royal Roads University (RRU), Canada (Muzio, Heins, & Mundell, 2002). CEDAR offers mid-career learners postsecondary education and has been internationally known for pioneering the creation and reuse of learning objects. Tagged learning objects are stored in a database. For course content, E-learning course developers first search for existing learning objects from the database. When they cannot find the appropriate learning objects for their courses, they create learning objects with the help of

subject matter experts. Using a course editor tool, they assemble these learning objects into a course. When assembling learning objects, developers follow instructional design strategies suggested by a course editor tool. They are asked to state respective learning outcomes at course and unit levels. Also, by identifying the level of Bloom's taxonomy (Bloom, Englehart, Furst, Hill, & Krathwell, 1956) of each learning outcome, developers can check whether learning objects are engaged in stimulating higher order thinking skills, in addition to a basic understanding of concepts.

On the same note, Recker, Dorward, and Nelson (2004) have developed a system to help K-12 math and science teachers use existing learning objects from a public repository. Specifically, the authors were interested in helping math and science teachers to search for, choose, and use learning objects for their own instructional practice. For the public repository of their study, they chose the National Science Digital Library (NSDL). To help teachers to utilize NSDL, the authors developed a tool which guided teachers to reuse learning objects for their own teaching settings. The results showed that this tool helped teachers search, choose, sequence, and aggregate learning objects for their own instruction.

Learners. Recently, researchers have focused on learners by envisioning that the use of learning objects could control a new learning environment where the exchange of instructional content is common among learners. According to Collis and Strijker (2001), learners could have greater control over their learning experiences with the ability to create learning objects and share them with others, in addition to using existing learning objects for their own learning. The authors emphasize that this approach would promote more engagement and deeper learning of the subjects. Furthermore, Duval, Hodgins, Rehak, and Robson (2004) maintain that the focus on learners would make learning object-based instruction popular in the mainstream learning

settings as currently, the learning objects approach is considered as a domain restricted to a limited number of researchers.

To offer learners more control over the use of learning objects, researchers have proposed a learning object-based system where learners are creators of their own learning. Tan, Aris, and Abu (2006) emphasize the importance of giving learners more control over their own learning. They propose a learning object-based system to help learners to find, select, modify, and organize learning objects to construct their own learning. Similarly, McGee (2006) suggests an instructional design model for learning objects by stressing the change of the role of learners. . In this model, learners share learning objects that they generate for their own learning and thereby contribute to the body of knowledge of the whole community. Also, Bannan-Ritland, Dabbagh, and Murphy (2002) introduce a learning object system to support a constructivist learning environment. With the help of this system, learners could get guidance on instructional strategies to design their own learning without difficulty.

Learning Objects and Instructional Design Theories and Strategies

In an effort to utilize learning objects to promote learning effectiveness, researchers have suggested an instructional theory to guide the design, development, and application of learning objects. Based on these theoretical suggestions, learning object-based instructions have been developed and implemented by reflecting instructional strategies. Many of the instructional strategies which are utilized in the development of learning object-based instruction are based on behaviorism, cognitivism and constructivism.

Learning Object Development Guided by Learning Strategies. Farrell and Carr (2007) propose a blended learning object design model by incorporating the ADDIE (Analyze, Design, Develop, Implement, and Evaluate) model, Constructivist Learning Environments (CLEs) and

Hypermedia Design Model (HDM). Their hybrid model features ADDIE's systematic and comprehensive designing strategies, CLE's problem solving approach, and HDM's focus on designer guidance and learner control. At the same time, the authors incorporate the unique features of learning objects such as granularity, combination, accessibility, and reusability. At the analysis stage, instructional designers conduct a needs assessment to identify the problems that learning objects need to address. At the start of the design and development stage, meaningful and authentic problems for learners are determined and learning objectives are developed. This is followed by the identification of granularity and sequencing of learning objects. Then, instructional designers are engaged in the development of a learning object prototype by incorporating constructivist strategies including self-reflection, learner control, learner choice, learner feedback, and authentic context. This model features rapid prototyping because this stage involves the simultaneous process of design, development, and learner feedback. At the implementation stage, learning objects are tagged with the metadata to promote accessibility and reuse among learners and instructors. Meta-tagged learning objects are stored in the learning object repository. At the evaluation stage, summative evaluation is done to determine the effectiveness of developed learning objects, while formative evaluation is implemented during the design and development stages.

Instructional Strategies Utilized in Post-Secondary School Context. The current literature has been further analyzed to identify instructional strategies which have guided the design and development of learning objects in real situations. To get some ideas on instructional strategies actually utilized, instructional strategies have been drawn from the literature based on real design and development of learning objects. As most of the learning object studies have been conducted in post-secondary school settings (Kay, 2007), the current literature review has

led to the findings on instructional strategies in post-secondary school settings. Three learning theories – behaviorism, cognitivism, and constructivism - have been utilized.

More specifically, based on constructivism, many instructional strategies have guided the design and development of learning objects. Learner control and learner choice features have been incorporated in learning objects. For example, the learner controls some aspects of acquiring object-based learning including sequence and pace (Bradley & Boyle, 2004; Farrell & Carr, 2007; Krauss & Ally, 2005; Lim, et al., 2006). Moreover, some learning objects are designed to provide learner choice over learning strategies and others (Cochrane, 2007; Farrell & Carr, 2007; Lim, et al., 2006). To promote a deeper learning process for learners, self-reflection is incorporated into learning objects as well (Farrell & Carr, 2007; Krauss & Ally, 2005). To make learning more relevant to subjects, authentic and concrete problems and examples are provided (Farrell & Carr, 2007; Nugent, et al., 2006). Instead of passively receiving instruction, learners are required to generate the solution to problems and to offer feedback (Bradley & Boyle, 2004; Farrell & Carr, 2007; Krauss & Ally, 2005).

By being guided by behaviorist approaches, feedback functions are embedded in the learning objects to indicate students' progress (Krauss & Ally, 2005; Nugent, et al., 2006). Furthermore, Krauss and Ally develop learning objects by establishing learning objectives in observable terms while aggregating learning objects by sequencing them, starting from mere knowledge gains to higher order thinking skills. Based on cognitivist approaches, some efforts are made to activate prior knowledge and deposit information into the long-term memory by providing background information and by demonstrating interrelationships among important concepts (Krauss & Ally, 2005; Nugent, et al., 2006). Further, some visual supports have been

adopted to promote learning of abstract concepts by directing learners' attention to important features of learning (Bradley & Boyle, 2004; Krauss & Ally, 2005).

Granularity

Granularity is a descriptor of the size of learning objects. As the granularity issue has been one of the most predominant issues in applying learning objects in education, many researchers have tried to define the optimal granularity level (Wiley, 2002). Nevertheless, there has been no consensus on the optimal granularity level. In addition, there has been some confusion as to what the granularity levels exactly represent. With a view to contributing to the body of knowledge concerning granularity levels, the present study seeks to explore what granularity levels are utilized across various organizations.

Granularity Levels of Learning Objects. According to Wiley, Gibbons, and Recker (2000), a media-centric view is the most widely used perspective on granularity levels. As its name indicates, the media-centric view considers media as the basis for aggregating units into increasingly larger reusable learning objects. This view is, in fact, similar to a traditional course hierarchy. One educational medium represents the smallest grain size. When some of these small media are aggregated, an initial level (Level 1) resource is produced. Then, when some of these Level 1 resources are aggregated, a Level 2 resource is created. Finally, some of the Level 2 resources are aggregated into the full course representing the largest grain size. This view is held by most of the major organizations involved in the standardization of learning objects, including IMS Global Learning Consortium (2004), the ADL (2004) Network, and the Learning Objects Metadata working group of the IEEE's Learning Technology Standards Committee (2002).

Specifically, ADL's Sharable Content Object Reference Model (SCORM) has four levels of granularity of learning objects (ADL, 2004). These four levels are assets, sharable content

objects (SCO), content aggregation, and content model. “Assets” refer to electronic versions of media, including text, sound, images, assessment, etc. When several assets are aggregated, they become SCO’s and can be tracked by the Learning Management System (LMS). When several SCO’s are aggregated, they become a content aggregation, which represents a lesson. Finally, several content aggregations comprise a SCORM content model, which is similar to a full course.

Similar to SCORM levels, Bannan-Ritland, Dabbagh, and Murphy (2002) suggest three levels of granularity. The first level represents a learning object at the micro-level. It consists of content and other optional components including media, concepts, cases, and problem statements. The second level represents combined learning objects. This level contains the content, context, learning activities, and some instructional strategies. The third level is called “frameworks” which aggregate other learning objects and represent macro-level scaffolding. In addition, the granularity levels of Cisco’s model (Cisco, 2003) are similar to those of SCORM, but it has one more level than SCORM. Cisco’s five level hierarchy is comprised of subtopics, topics, lessons, modules, and (complete) course. Subtopics hold content made of media and texts. Subtopics are aggregated into topics. In addition to subtopics, topics contain objectives, practice items, assessment items, and metadata. Then, topics are aggregated into lessons. With topics embedded, the lesson is in its complete form with an overview, a summary, practice, and assessment. Subsequently, topics are aggregated into modules, which, in turn, are aggregated into a course. Just like the structure of lessons, both modules and topics contain an overview, practice, assessment, and summary at their respective levels, in addition to components of the previous level of reusable objects.

By integrating various granularity levels as discussed above, the present study assigns these five levels to represent the various granularity levels of reusable objects. The first level, assets, represents a raw medium or some text, which is similar to the smallest grain size of SCORM. The second level is composed of combined media, sharing similarities with the first level of Bannan-Ritland, Dabbagh, and Murphy's model (2002), and the "subtopic" of Cisco's model (2003). The third level represents a basic size of learning objects comprised of the second level, combined media, which is similar to SCO of SCORM, the second level of Bannan-Ritland, Dabbagh, and Murphy's model, and "topic" of Cisco's model. The fourth level represents combined learning objects, which is similar to the content aggregation level of SCORM, and "lesson" and "module" of Cisco's model. The fifth level represents aggregated fourth levels, which is similar to the largest grain size of SCORM, the third level of Bannan-Ritland, Dabbagh, and Murphy's model, and "course" of Cisco's model.

Table 2. Learning object granularity levels and definitions

Level	**Definition**
Level 1: Asset	Single discrete unit of information such as text, image, sound, etc
Level 2: Combined media	Consists of text and a combination of optional media (image, sound, animation, etc)
Level 3: Unit	Consists of several combined media. Might have some components such as learning objective, content, practice, assessment with media
Level 4: Lesson or module	Consists of several units
Level 5: Course	Consists of several lessons or modules

Further Explanation of the Five Granularity Levels. The literature review shows that the unit has received significant attention as this level represents the basic level of learning objects (Kay, 2007; Lim, Lee, & Richards, 2006; Nugent, Soh, & Samal, 2006). As Wiley (2002) notes, determining the basic grain size of learning objects has been one of the most important issues in designing learning objects. Many attempts have been made to define the optimal size of learning objects at the unit level. Along with the unit level, the combined media is introduced to explain the components of the unit (Bradley & Boyle, 2004; Jonassen & Churchill, 2004). There has

been a lack of studies focusing on the combined media level. The same may be said of the asset level. This lack of study is due to the fact that these levels have been considered as information objects or mere assets because of their lack of educational value. Compared with the asset and combined media levels, the course level has gotten more attention partially because learning objects are being presented to students in the form of a course. This explains why some of the current evaluation of the effectiveness of learning objects has been done at the course level (Bradley & Boyle, 2004; Lim, et al., 2006). As with the asset and combined media levels of learning objects, there is a lack of research dealing with the lesson or module level (Moisey, Spencer, & Bob, 2006).

Advantages and Disadvantages. The first and second levels represent smaller grain size of reusable objects compared with other levels. Because of their small size, lower levels of reusable objects are more easily reused (Griffiths, 2007; Wiley, et al., 2000). The first granularity level is comprised of raw media or some fragments of text, while the second level is comprised of several combined media. So, when these levels are presented to learners, they might not be able to learn anything meaningful because the sizes are too small to contain appropriate content, context, etc. In addition, there is some difficulty with meta-tagging these low granularity levels. To make learning objects accessible and available, learning objects need to be tagged by the metadata, which labels the information of learning objects. By tracking the metadata, learning objects can be investigated. There are many metadata fields to fill. For example, in the case of the metadata suggested by IEEE, there are more than 70 metadata fields for each learning object (IEEE, 2002). So, if every medium at these levels needs to be tagged by metadata, the process will be too time-consuming. This explains why the SCORM model does not meta-tag assets.

The third level represents the basic unit of learning objects, as suggested by many researchers. Even though there is no consensus on the optimal size of this level among researchers, compared with other levels, this level is small enough to be reused in other contexts, while not too small to contain a context for effective learning (Kay & Knaack, 2007b; Nugent, et al., 2006). Specifically, as the unit is not too small, tagging learning objects with metadata is not too time-consuming nor too costly. That is why the SCORM model has started meta-tagging learning objects at this point. In terms of learning effectiveness, compared with Levels 1 and 2, this level is more likely to bring out more meaningful learning as it can contain some contexts. In addition, compared with the fourth and fifth levels, it has more advantages in terms of the attention span of students, since one learning object can last less than 15 minutes (Bradley & Boyle, 2004). However, in contrast to the fourth and fifth levels, this third level usually builds around one learning objective or one concept (Cisco, 2003; South & Monson, 2002); thus it might not be effective for meaningful learning when students need to get involved in complex learning tasks.

Compared with the third level, the fourth level might be less flexible in terms of the reuse in other contexts. But more meaningful learning is possible as it can include more contexts and instructional strategies than lower levels. In a similar vein, the fifth level will be more beneficial to learners, compared with the other lower levels, especially as they need to get involved in complex learning tasks. As the fifth level consists of various lessons and modules, it can engage the learner in more difficult tasks. Also, the fifth level can be more easily utilized for educational purposes. For example, the fifth level has been found to be more beneficial for teachers who prefer reusing a ready-made online course instead of creating the same course by combining all lower levels of reusable learning objects (South & Monson, 2002). While there are some users

who prefer the reuse of the fifth level as it is, generally, it will be very difficult for this level to be reused in other contexts. If it is not used as it is, there will be too many things to be modified to fit into specific contexts.

Factors to be Considered When Selecting a Granularity Level. Reusability needs to be considered in selecting a granularity level because it is one of the greatest benefits of learning objects. While lower levels of learning objects are more easily reused in different contexts, higher levels of learning objects are difficult to reuse (Wiley, et al., 2000). In one study (Recker, et al., 2006), teachers were given different granularity levels of learning objects to design their instruction for their classes and their use of learning objects was examined. According to the results, the low levels of reusable objects were most frequently used.

Metadata-tagging needs to be another consideration for the level selection. After learning objects are meta-tagged, they are stored in the learning object system. Using metadata, the system can track and retrieve learning objects. It will be too costly and difficult if the system needs to meta-tag every level as metadata consists of many items (South & Monson, 2002). Which level will be meta-tagged depends on the financial resources of the particular learning object system, not the choice of individual instructional designers and developers (Kang, Lim, & Kim, 2004). The metadata-tagging starts with the smallest size of learning objects that the learning object system can handle.

Another consideration is the learning effectiveness in relation to the instructional content. From an instructional perspective, a smaller grain size of reusable objects does not translate into greater learning benefits as it is difficult to include the context in small grain sizes. Wiley (2000) recommends selecting granularity levels that are not very low. Furthermore, when learning involves complex content to promote deep and meaningful learning, larger grain sizes of learning

objects need to be utilized (McGee, 2006). Therefore, the complexity of the instructional content must be considered in the choice of granularity level. Also, certain characteristics of instructional designers/developers and learners need to be considered. For example, when users create an instruction by reusing learning objects, their instructional designing capability and knowledge of subject matter need to be taken into account in selecting a granularity level appropriate for individual users (Recker, Dorward, & Nelson, 2004).

Summary

The present study has focused on the utilization of learning objects for instructional designers and developers. More specifically, it has explored the design strategies and granularity levels that current instructional designers and instructors are utilizing. The results of the present study are expected to provide guidance for instructional designers and developers to use design strategies and granularity levels appropriate for their own instructional practices.

Perceived Benefits of Learning Objects

To explore perceived benefits of learning objects, some studies have been conducted focusing mainly on the perceived learning benefits for students (Kay, 2007; Kay & Knaack, 2007c). Furthermore, learning benefits for secondary school students have been explored via teachers' perspectives on the effects on students (Kay & Knaack, 2007a; Kay & Knaack, 2008a). Other studies have examined the benefits for teachers; two, in fact, (McCormick & Li, 2006; Recker, et al., 2006) have investigated teachers' perspectives and found the overall usefulness of learning objects for K-12 teachers. However, these studies involve only students and teachers who are reusing learning objects, without modifying and creating learning objects. Thus, there is a dearth of studies examining the benefits of learning objects in terms of the instructional design and development process.

Learners' Benefits

Learners' Perspective on Benefits for Their Own Learning. Some studies have examined the benefits of learning objects from learners' perspectives. By surveying 221 secondary school students in grades 9, 11, and 12, Kay (2007) found a positive perceived benefit for their own learning. Also, the authors found that specific design features that students thought highly of included motivation, interactivity, and visual support. Furthermore, Kay and Knaack (2008a) explored the individual differences based on 850 secondary school students from fifteen schools. As individual characteristics, the authors examined gender, computer comfort, age, and grade. The dependent variables were the students' perceived benefits on learning and their performance. The results detected age difference as a significant factor, while there was no significant difference regarding gender. The twelfth graders demonstrated better performance and more positive perception than the ninth and eleventh graders. Additionally, degree of computer comfort did not make a difference in the performance, but it did make a difference in the perceived learning benefits.

Other studies have been conducted in post-secondary school settings. Using learning objects, Bradley and Boyle (2004) developed a course on introductory computer programming and found that there was improvement in the passing rate among students, from 12% to 23%. For working engineers, Cochrane (2005) developed learning object-based instruction on audio engineering, and found that a high level of learner interactivity was important to the motivation and engagement of the learners.

Teachers' Perspective on Benefits for Students. Kay and Knaack (2007c) examined the benefits for students via teachers' perceptions. They surveyed 33 math and science teachers from secondary schools. Most of the teachers agreed that learning objects contributed to students'

learning successfully and were beneficial for their engagement. Furthermore, Kay and Knaack (2008b) compared perceived benefits for students with teachers. Based on their survey of 850 students and 27 teachers, they found that both the teachers and students agreed that learning objects were effective in students' learning and engagement. Overall, the teachers were more positive than the students, especially in regard to the students' engagement.

McCormick and Li (2006) reported the survey results from the Context eLearning with Broadband Technologies (CELEBRATE) project, which developed learning objects to encourage their use in the classrooms. The CELEBRATE study involved seven hundred seventy teachers from 500 schools across six European countries. Of these teachers, 55% believed that learning objects successfully promoted student learning. Also, over 60% of the teachers concurred on the effectiveness in maintaining students' engagement and motivation.

Teachers' Perspective on Benefits on Their Own Teaching

McCormick and Li (2006) reported the benefits for teachers based on a sample of 770 teachers who used existing learning objects for their own classroom. Approximately 70% of the teachers demonstrated an overall positive perception on their usefulness. Specifically, 56% of the teachers thought that learning objects effectively contributed to their teaching practices. Kay (2007) examined thirty secondary school teachers who provided their feedback on the use of learning objects via a survey. Overall, the teachers perceived that learning objects were beneficial as a learning strategy for their classes, and, accordingly, were willing to use learning objects for their classes again.

Recker (2007) echoed the positive perception by teachers. The author explored how thirteen K-12 teachers from two rural school districts used learning objects for their classrooms. The teachers accessed a learning object repository and developed their instruction by utilizing

existing learning objects. They believed that learning objects were important for quality education. In fact, they thought that learning objects made their job easier and indicated a desire to use the learning object approach more extensively.

Reusability and Interoperability

Reusability brings out one of the key benefits of learning objects to support the instructional design and development process. Instructional designers and developers can produce new courses more easily by reusing existing learning resources, instead of having to develop new courses from the beginning. The importance of reusability has been repeatedly emphasized by researchers (Nugent, et al., 2006; Parrish, 2004).

To evaluate the quality of existing learning objects, Multimedia Educational Resource for Learning and Online Teaching (MERLOT, 2002) developed the Learning Object Rating Instrument (LORI). As one of the items on LORI, reusability was included by asking respondents to rate learning objects in terms of "ability to port between different courses or learning contexts without modification" (Nesbit, Belfer, & Vargo, 2002). By modifying LORI for his own study, Cochrane (2005) measured the reusability of learning objects for engineers and found positive responses from these engineers.

Similarly, McCormick and Li (2006) studied teachers' perceptions on the flexibility of learning objects for different learning contexts and detected some mixed results. About three-quarters of the teachers reported that learning objects were flexible for both individual and collaborative work for the class. However, 30% of them had difficulty with fitting learning objects into whole-class instruction and into student activities. Based on interview results, the authors speculated that the negative response might be related to the teachers' computer skills

since those with high computer skills did not demonstrate any difficulties with fitting learning objects into their current teaching practices.

To be reusable in different settings, learning objects need to feature interoperability–the ability to be functional across different systems without technical difficulties. Exploring the concept further, McCormick and Li (2006) showed that about half of the teachers surveyed experienced technical issues owing to the special software. The interview results showed that the technical problems were due to issues related to the infrastructure of each school, not the learning objects themselves, nor the repository of learning objects. Great technical difficulties in accessing learning objects were detected among teachers from some schools using Linux operating system because some learning objects were not compatible with this operating system.

Time and Cost

Studies were conducted to explore the benefits in terms of the decrease in the time and cost to develop courses. However, there was no consensus on time and cost effectiveness. Based on a survey on 33 teachers from secondary schools, Kay and Knaack (2007c) examined the time it took them to locate and prepare for the reuse of learning objects for their classes. The teachers commented that they had spent a significant amount of time preparing to use learning objects. Also, they reported that the teachers needed preparation time to successfully integrate existing learning objects into their own teaching practice. About 60% of them reported spending more than 30 minutes finding an appropriate learning object. Regarding the preparation time for the reuse of learning objects for their own teaching purposes, there were mixed reactions. About half of them spent less than 30 minutes.

Kay and Knaack (2008b) found similar results by surveying 27 secondary school teachers of science, mathematics, or social sciences. Roughly, on the average, secondary school teachers

spent one to two hours to locate suitable learning objects and prepare lesson plans with learning objects. Regarding the time spent, many teachers expressed concern that they did not spend much time in preparing their regular lesson plans.

Christiansen and Anderson (2004) reported mixed reactions to the time and cost of developing a course based on learning objects. The authors explored three different case studies in different fields. One team, which developed business courses, commented that searching and aggregating discrete learning objects into a course was not cost-or time-effective. On the other hand, another team which developed nursing courses believed that the learning object approach speeded up the course development process. Also, they reported that learning objects made the course editing and revision process easier and faster compared with the traditional approach. In contrast to these two teams, the team developing the literature courses could not find any difference in terms of the time and cost involved compared with the traditional approach.

As an effort to shorten the course time, Wang and Hsu (2006) developed a system which supports the reuse of learning objects. The authors conducted experiments to examine the course development time. Half of the instructional designers developed a new course using a traditional method while the other half developed a learning object based course. According to the experimental results, the teachers using the traditional method took about two hours to develop a new course, those using the object-based system took about 22 minutes.

Support for Interactivity and Motivation

Studies were conducted to explore the pedagogical aspects of learning objects, with focused attention on motivation and interactivity features. Studies (Kay, 2007; Kay & Knaack, 2007b; McCormick & Li, 2006) showed that both K-12 school teachers and students perceived that learning objects were effective in motivating and engaging the students. Also, some

researchers have been engaged in incorporating interactivity into learning objects. Bradley and Boyle (2004) developed learning objects with different levels of interactivity for post-secondary school students. Cochrane (2005) found a positive perception of users towards interactivity features of learning objects. Furthermore, they showed that interactivity was related to students' motivation and engagement.

Reflecting interest in pedagogical features of learning objects, some attempts have been made to evaluate these features. LORI has items to evaluate motivation and interaction feedback and adaptation (Nesbit, Belfer & Leacock, 2002). Motivation has been operationalized as the "ability to motivate, and stimulate the interests of, an identified population of learners" (p. 2). Interaction feedback and adaptation are defined as "adaptive content driven by differential learner input or learner modeling" (p. 2). Based on LORI, Krauss and Ally (2005) asked faculty members to evaluate learning objects that were developed to teach therapeutic principles of drug administration. The results showed a high rating in motivation but the lowest rating in the interaction and feedback/adaptation features.

Summary

While studies report positive perceptions on learning objects for students and teachers, the current literature review reveals the need for further study to address broader perspectives by involving instructional designers and developers. While many efforts have been made to support the instructional design and development processes using learning objects, there is a lack of studies examining the perceived benefits of learning objects from instructional designers and developers. In response to this dearth of information, the present study attempts to explore the perceived benefits of learning objects in terms of reusability, time and cost, and the support for interactivity and motivation.

The Adoption Status of Learning Objects

There is a lack of theoretical studies on the adoption status of learning objects across various settings. Accordingly, this study has made use of Rogers' Innovation Decision Model (2003) in exploring the diffusion status of learning objects, beginning with a literature review of the intentions to use and the actual usage of learning objects. Moreover, in order to explore the adoption factors of learning objects, the present study examines individual and organizational characteristics along with their perceived ease of use and usefulness.

Rogers' Innovation-Decision Model

According to Rogers (2003), there are five stages involved in the innovation decision process: "knowledge," "persuasion," "decision," "implementation," and "confirmation." At the knowledge stage, individuals are aware of the existence of an innovation and its attributes. In the following stage, individuals are persuaded of the benefits of an innovation and are engaged in collecting more information to examine the pros and cons of the adoption of the innovation. The persuasion stage is followed by the decision stage, in which individuals make a decision on whether they will adopt or refuse the innovation. In the implementation stage, individuals put the innovation into effect. In the last stage, individuals decide whether they will continue to use or reject the adoption of the innovation. While Rogers supports the existence of these stages of the innovation decision process, he mentions that the innovation decision process is too complex for researchers to examine because it is a mental process. Regarding the five stages, Rogers goes on to say that there is a very clear distinction between the knowledge and decision stages, while the persuasion stage is not clearly distinguished from the other stages.

Based on Rogers' five stages of the innovation decision process, other investigators have measured the adoption status of an innovation. For example, by basing their theoretical

background on Rogers' model, Sultan and Chan (2000) examined the adoption status of new technologies among software companies. Since these adoption decisions were made by firms, rather than individuals, Sultan and Chan asked the respondents to indicate the current usage status of a particular new technology by their functional group. They reasoned that the current usage status by the functional group indicated the individual usage status in a situation where the adoption decision was made at the organizational level. Individuals chose to adopt the technology that their functional group chose to adopt regardless of their personal preferences.

Ahn, Beamish, and Goss (2008) developed survey items using Rogers' Innovation-Decision Process to examine the acceptance status of technologies. Respondents were asked to indicate their perception and acceptance status of technologies by choosing an item which represents each stage of Rogers' Innovation Process. The authors examined the knowledge-, persuasion-, decision- and implementation stages. Different from the Rogers' five stages, the authors added "purchased but not used or rarely used" to verify whether those who purchased technologies actually used them or not. Another difference was detected as the authors did not include an item at the confirmation stage

Beyond the adoption and diffusion suggested by Rogers, Surry and Ely (2002) emphasized the implementation and institutionalization of innovations in the IDT field. Surry and Ely mentioned that implementation should be included as a part of the change. By citing Fullman, Surry and Ely explained implementation as "the actual use of the innovation in practice" (p.188). According to the authors, implementation resulted in the institutionalization of technology. At the institutionalization stage, the innovation is routinely used in the organization and no longer considered an innovation. The authors mentioned that institutionalization can be the criteria to determine the real success of the adoption of the technology.

Actual Usage

In exploring the diffusion status of technology, researchers have investigated actual usage because they consider actual usage important enough to guarantee a positive outcome of investment (Taylor & Todd, 1995). To explore the actual usage, Sooknanan, Melkote, and Skinner (2002) utilized the implementation status. Considering implementation as the process of putting an innovation into use, the authors operationalized it with individuals' perceptions toward satisfaction and utilization of the innovation. Satisfaction was measured based on the accessibility of technologies and the fulfillment of users' expectations. Utilization was operationalized according to the acceptance status and frequency of use of the technology in question.

To explore the actual usage, other studies have measured the frequency level along a five-to-seven point scale. Davis, Bagozzi, and Warshaw (1989) suggested measuring the current usage of the innovations in terms of the utilization frequency. Respondents indicated their implementation status using a seven-point Likert scale. The authors supported their self-reported use of seven points by emphasizing that this scale is common in measuring system usage where there are no objective metrics embedded in the system. However, the authors warned about a possible discrepancy between the actual and any self-reported usage. On the other hand,, some researchers have utilized a five-point scale. In exploring the diffusion of educational technology, Sahin and Thompson (2006) measured the actual usage of computers for educational purposes, asking respondents to rate their current usage of computers for instructional purposes from "never" to "seldom" to "sometimes" to "often" to "very often."

Intentions to Use

In exploring the usage of technology beyond current usage, some studies have attempted to explore intentions to use. Slyke, Lou, and Day (2002) explored "the intention to use new technology" (p.7) as a dependent variable. While they admitted the actual usage and intention to adopt were not the same, they justified the inclusion of the intention to use on the basis of the close relation between the intention and actual usage. They measured intention to use in terms of respondents' perception of how likely they were to use new technology in the near future. Ilie, Van Slyke, Green, and Lou (2005) also employed "intention to use" (p.22) as the dependent variable in their study examining the adoption of communication technologies using the theoretical background of the Diffusion of Innovation Process. To measure the intention to use, they developed five different survey items by asking respondents to score them on a seven-point Likert scale.

Furthermore, Liao and Lu (2007) examined two different intentions—"intention to use" (p.4) and "intention of continued use" (p.4) —of eLearning websites. They assessed the intention of adoption for learners with no prior experience with eLearning websites while assessing the intention of continued use for learners with prior experience. The authors measured "intention of adoption," "intention of continued use," "actual adoption," and "continued use" (p.6). Similarly, Lau and Woods (2008) measured intention to use learning objects among potential users in higher education settings. Lau and Woods measured "intention to use," "intention to increase the use," and "intention to adopt" (p.699).

Individual Characteristics and Adoption Status

As potential variables to influence the adoption status of new technologies, some studies have chosen individual characteristics. Sahin and Thompson (2006) measured computer

expertise and attitude toward the use of computers to explore the impact of the use of computers on instruction among faculty members. They found that computer expertise was most significantly related to the adoption of the computer use for instructional purposes, followed by a positive attitude of the faculty members.

Sultan and Chan (2000) examined participants' experience level and identity with company values as influences in the adoption status of new technologies. The authors measured identity with company values by asking whether participants agreed with their company values. The results showed a significant effect of individuals' identity with the company values on adoption status of new technologies. In addition, they found a significant effect of participants' experience, which was operationalized into years on the job, years of knowledge of new technology, and years with the firm. The significant effect of experience was also found by Liao and Lu (2007). Previous experience with the new technology was found to have a significant effect on the adoption of new technology. There was also a direct effect of prior experience on intentions of continued use.

Organizational Characteristics and the Adoption

Sultan and Chan (2000) examined the influence of organizational characteristics on the technology adoption status of actual users. Adoption status was found to be positively related to the existence of technology policies to guide the selection and adoption process of the technology. Also, the company's competitive orientation positively influenced the adoption. Finally, top management's tendency to take risks and support their employees was found to have a positive relationship with the adoption. In examining the organizational characteristics by surveying 154 senior executives of large companies, Lin and Lee (2006) found that the positive

factors included top management support, reward systems in utilizing the innovation, communication, encouragement to produce new ideas, and active interaction among employees.

Ko, Kim, Kim and Woo (2008) surveyed 94 companies to determine the effect of organizational characteristics on the adoption decision. The authors found that the maturity of an IT system was positively related to the adoption and the utilization level of the system in question. In terms of the size of the company, the larger the size of the company the more positive was the influence on the adoption and the utilization status of new technology. The larger companies tended to adopt and utilize new technology more aggressively.

Adoption Factors: Perceived Ease of Use and Usefulness

Davis (1989) developed scales of "perceived usefulness" and "perceived ease of use" to explore the future and current usage of computers. He defined perceived usefulness as "the degree to which a person believes that using a particular system would enhance his or her job performance" (p.320). He went on to define perceived ease of use as "the degree to which a person believes that using a particular system would be free of effort" (p.320). By testing 152 users, Davis found that perceived ease of use was significantly correlated with both current and future usage of technology, with perceived usefulness having the same relationship with current and future usage.

By utilizing items of Davis (1989), Lau and Woods (2008) examined how the use of learning objects was influenced by perceived usefulness and perceived ease of use. Lau and Woods found a significant relationship between these two factors and the attitudes of potential users towards the utilization of learning objects. Users' perceived usefulness had stronger effects, compared with perceived ease of use. Based on the direct relationship between individual

attitude and intentions to use, Lau and Woods concluded that perceived usefulness was the most influential factor that affected the acceptance of learning objects by potential users.

Other studies have been conducted to examine the role of ease of use based on other models than Davis', and they have showed mixed results. As one of the important variables to investigate the adoption and use of emerging technologies, Ilie, VanSlyke, Green, and Lou (2005) used perceived ease of use, grounded on the model of Moore and Bensabat (1981). The authors found that perceived ease of use predicted intentions of use significantly. By modifying Moore and Benbasat's model for their study, Liao and Lu explored the influence of the ease of use on the adoption and continued use of eLearning. The authors (2008, p. 6) define ease of use as the "degree to which an innovation is considered by a learner as relatively easy to use and understand." The authors found that ease of use did not have any significant relationship with either the intentions of continued use or the intentions of adoption.

Summary

There is a lack of studies to explore the adoption status of learning objects based on a theoretical foundation. Some studies have attempted to examine the adoption status of learning objects, but they have only concluded that there is a need for the future study across various settings. Also, while there was a study dealing with the adoption status of learning objects based on the Technology Acceptance Model (TAM) model (Davis, 1989; Davis, Bagozzi & Warshaw, 1989), the study was conducted on potential users of learning objects, not actual users.

In response to this shortage of empirical investigations, the present study attempts to explore the adoption status of learning objects of real users across various organizations using as its theoretical basis Rogers' Diffusion of Innovations theory (2003). In addition to describing the current implementation status, this study seeks to predict the future use of learning objects

among practitioners across various organizations by determining the general awareness of and intentions to use learning objects among real users. Furthermore, it explores certain characteristics of organizations that currently use learning objects, as well as investigates the perceived ease of use and perceived usefulness as potential factors for the current use of learning objects. The results of the present study are expected to fill the research gap examining the adoption status of learning objects with a theoretical background across various organizations in the IDT field. In sum, it is hoped that these results will contribute to the knowledge base concerning the future adoption status of learning objects and the adoption factors influencing their incorporation in the IDT field.

Chapter Three: Methodology

Learning objects have received much attention because of their potential to improve the current methods of teaching and learning (Wiley, 2002). However, most studies on learning objects have been conducted in the context of one single setting, and there is a lack of research exploring the actual use and potential of learning objects across various contexts. Furthermore, those studies on the actual use of learning objects are based on the perspectives of learners and teachers. There is a research gap with regard to the actual use of learning objects based on the perceptions of instructional developers and designers who have been involved in the creation and reuse process of learning objects. To fill this research gap, the current study attempted to investigate the actual use and perceptions of learning objects across various organizations based on data from Instructional Design and Technology (IDT) practitioners. Specifically, this study examined how learning objects were defined, used, perceived, and adopted across varying settings.

Research Questions

Based on the needs of the study, research questions and their ancillary sub-questions were as follows:

(1) What is the current conceptualization of learning objects?

(2) How are learning objects currently being used across varying organizations? What sizes of learning objects are IDT practitioners using? What design strategies are IDT practitioners adopting when using learning objects?

(3) What are the perceived benefits of learning objects in terms of their support for instructional design and development?

(4) What is the adoption status of learning objects across varying settings? How do adoption factors affect the current use of learning objects?

Design and Procedures

This study utilized a descriptive approach, as the purpose of the current study is to describe and understand the perception and use of learning objects by the population of interest, which is the very nature of descriptive studies (Rossman & Rallis, 2002). The current study adopted both quantitative and qualitative research methodologies as incorporated in descriptive approaches. To analyze quantitative data from the majority of research questions, quantitative methods were used. Likewise, the qualitative data from open-ended questions was investigated by qualitative methods.

To collect the data, this study used a survey method, which is frequently used for descriptive studies (Leedy & Ormrod, 2005) and is popular in the educational field to examine psychological, socio-cultural, and behavioral constructs (Kerr, 2003; Seels, Fullerton, Berry, & Horn, 2003). A cross-sectional survey was used by collecting data from the target population from various organizations at just one point in time (Fraenkel & Wallen, 2005). To collect the data, a questionnaire was developed and a web-based survey was administered to the target population.

Instrument

In order to explore perceptions and actual use of learning objects among IDT practitioners, a questionnaire was developed to collect the data. The basis for the questionnaire was literature in the fields of education, Instructional Design and Technology, computer science, and engineering. The literature in Chapter Two provided background information on important topics related to learning objects. Specifically, to explore the actual use and perceptions of

learning objects, the study chose the conceptualization, utilization, perceived benefits, and adoption status of learning objects as topics of interest. These topics of interest were constructed as survey questions and items for the instrument of the study. The survey instrument of this study was developed and administered using survey software called SurveyMonkey (SurveyMonkey, 2009). SurveyMonkey is a web-based survey editor that enables the development of an online survey featuring customized types of questions. Also, SurveyMonkey has functions to collect and analyze data.

The survey of the proposed study consisted of items on demographics, concepts, and adoption status of learning objects. Specifically, the survey consisted of five parts: Background Information, Adoption Status of Learning Objects, Concepts of Learning Objects, Utilization of Learning Objects, and Perceived Benefits of Learning Objects (See Appendix A).

Part I: Background Information

Part I gathered information on characteristics of the respondents' institutions in relation to the adoption status of learning objects. Specific items included the type of organization and organizational size. In addition to organizational characteristics of the respondents, the survey contained items on respondents' characteristics such as job role, years of professional practice, and experience using learning objects.

Part II: Adoption Status of Learning Objects

Part II explored the adoption status of learning objects. Part II was comprised of five questions which examined adoption status, intentions to use, actual use, project-based use, and adoption factors.

Question One: Adoption Status. As stated previously, the study attempted to explore the extent to which learning objects have been adopted across various organizations based on the

Diffusion of Innovations theory (Rogers, 1995). To develop survey items examining Rogers' stages, the current study modified the items of Ahn, Beamish, and Goss (2008). Ahn, Beamish, and Goss developed survey items based on Rogers' Innovation-Decision Process to examine the acceptance status of technologies. Out of Rogers' stages, the authors did not include an item on confirmation stage, but added one option to identify participants who purchased but did not use or rarely used a technology.

Like the survey items of Ahn, Beamish, and Goss's model (2008), the study did not include the confirmation stage. Furthermore, the present study did not use the item to explore the adopters with rare use as the study used other survey items to examine the intention to use learning objects in the future for these adopters. As the implementation stage was emphasized by Surry and Ely (2002), the item of Ahn, Beamish and Goss was modified from "purchased" to "currently use learning objects." Since the adoption decision of learning objects is usually made at the organizational level because of the needed infrastructure for the implementation, the subject of that item was changed from "I" to "my organization."

In response to the first survey question on adoption status, respondents revealed their adoption status of learning objects by self-reporting the adoption stage of their organization. The scale on this item was "(a) Not familiar with learning objects, (b) Heard, seen or read about, but likely won't use, (c) My organization is seeking additional information and/or exploring implementation of learning objects, (d) Currently use learning objects."

Question Two: Intentions to Use. Some studies have attempted to explore intentions to use technology. Specifically, by considering the significant relationship between the actual usage and intention to use, studies were conducted by assessing the intentions to use various technologies including Lotus discussion database (Slyke et al., 2002), instant messaging (Ilie et

al., 2005) and knowledge management systems (Lin & Lee, 2006). Furthermore, studies examined two different intentions: intentions to use and intentions of continued use (Liao & Lu, 2007). The current study adopted the approaches of Liao and Lu to contribute further to the knowledge on the future diffusion status of learning objects. The data on the intentions of use and continued use would reveal the future diffusion status of learning objects. Also, the data on intentions could be interpreted as the data on the confirmation stage of Rogers' Innovation-Decision Model (2003). With modification of the scale of Liao and Lu (2007), intended future use of learning objects was measured by answering the following questions: "(a) My organization intends to increase the use of learning objects, (b) My organization intends to use learning objects in the future for work/learning." In response to these questions, respondents were asked to select from a seven-point Likert scale ranging from "strongly disagree" to "strongly agree."

Question Three: Actual Use. Together with intention to use, the current literature supported the investigation of actual usage of technology. In exploring the diffusion status of technology, some researchers considered it important to deal with the usage of the technology as actual usage in order to guarantee a positive investment outcome (Taylor & Todd, 1995). To reflect the importance of current usage in studies on the diffusion of learning objects, the present study attempted to investigate the current utilization of learning objects. The addition of these survey items was expected to complement Rogers' implementation stage (2003), which was not explored in previous survey scales on the adoption status of learning objects.

To develop the survey items on the current usage of learning objects, this study used the items from the instrument by Davis, Bagozzi, and Warshaw (1989). Based on the scales of Davis et al. (1989), respondents showed the implementation status of learning objects by choosing one

of the following options: “(a) don’t use at all, (b) use less than once each week, (c) use about once each week, (d) use several times a week, (e) use about once each day, (f) use several times each day” (p.991).

Question Four: Project-Based Use. Participants were also asked to indicate the actual usage of learning objects on a project basis. The fourth question asked respondents to choose one out of five options on the frequency of use of learning objects for “(a) less than 25% of projects, (b) more than 25 % and less than 50% of projects, (c) more than 50% and less than 75% of projects (d) more than 75% and less than 100% of projects (e) 100% of projects.” As much of the work of IDT practitioners is conducted on a project basis, the actual use of learning objects in projects would complement their actual use by frequency, resulting in a more comprehensive understanding of the actual use of learning objects among target participants.

Question Five: Adoption Factors. Finally, the study explored the adoption factors of learning objects. Specifically, the study identified perceived ease of use and usefulness as factors of interest based on the positive influence of these factors on the adoption status of technologies (Davis, 1989; Davis, Bagozzi, & Warshaw, 1989; Lau & Woods, 2008). The study modified the survey items of Lau and Woods (2008), which were based on the survey items from David (1989) and used for the study of learning objects. As the survey items of Lau and Woods were targeted for potential users of existing learning objects for their own learning, these items were customized for the target participants, who were IDT professionals.

Question Five had three sub-questions on adoption factors, which include perceived ease of use, perceived usefulness, and additional factors other than these two factors. The first sub-question on perceived ease of use asked participants to choose all applicable reasons for their current use of learning objects from the following items: “(a) Learning to use learning objects

would be easy for me, (b) I would find it easy to get a learning object to do what I want it to do, (c) My interaction with learning objects would be clear and understandable, (d) I would find learning objects flexible to interact with, (e) It would be easy for me to become skillful at using learning objects, (f) I would find learning objects easy to use."

The second sub-question on perceived usefulness requested the reasons for their use of learning objects from the six items "(a) Using learning objects would make it easier to design, develop, and teach course content, (b) Using learning objects would improve my teaching/developing performance, (c) Using learning objects would enhance my effectiveness in designing, developing, and teaching, (d) Using learning objects would increase my designing/developing/teaching productivity, (e) Using learning objects would help me to accomplish designing/developing/teaching tasks more quickly, (f) I would find learning objects useful in my designing/developing/teaching." The third sub-question asked respondents to provide any additional reasons for the adoption of learning objects.

Part III: Definition of Learning Objects

While many researchers have attempted to define learning objects, there has been no consensus on the definition (Fletcher, Tobias, & Wisher, 2007). However, the growing literature showed the evolution of the conceptualization of learning objects by shifting the focus from technical to learning aspects. Despite efforts to conceptualize learning objects by incorporating more learning theories, researchers expressed concern over the ever-present misconceptualization of learning objects with technical focus (Yahya & Yusoff, 2008). Moreover, Williams (2002) showed the need for future study to examine whether definitions of learning objects among users were aligned with those of the literature. In response, the present

study attempted to investigate current conceptualizations of learning objects among IDT practitioners.

Question One: Focus. The analysis of existing definitions of learning objects revealed the differences in terms of the focuses of current conceptualization. Some studies showed the focus on technical aspects (IEEE, 2002; Quinn, 2000; Northrup, Rasmussen, & Dawson, 2004), while other studies focused on learning aspects (Bradley & Boyle, 2004; Churchill, 2007; Parrish, 2004; Wiley, 2004). In addition, the combination of both was emphasized (Laverde, Cifuentes, & Rodríguez, 2007; Koper, 2003; Wiley, 2002). To investigate how IDT practitioners conceptualized learning objects, question one asked respondents to choose what they thought the definition should focus on from four options: "(a) Technical aspects, (b) Learning aspects, (c) The combination of both, (d) None of the above (Please explain)."

Question Two: Components. The analysis of the current concept showed three components to comprise the current conceptualization of learning objects: the digital resource (Laverde, et al., 2007; Cochrane, 2005; IEEE, 2002; Koper, 2003; Mavrommatis, 2008; Northrup, et al., 2004; Sosteric & Hesemeier, 2002; Wiley, 2002), reusability characteristics (Laverde, et al., 2007; Cisco, 2003; IEEE, 2002; Mavrommatis, 2008; Northrup, et al., 2004; Wiley, 2002), and educational purpose (Laverde, et al., 2007; Cisco, 2003; IEEE, 2002; Koper, 2003; Mavrommatis, 2008; Sosteric & Hesemeier, 2002; Wiley, 2002). To further investigate the current conceptualization of learning objects, these three identified components were constructed as survey items. The second question asked respondents to indicate how important they thought each of the three components were in terms of the definition of learning objects. Respondents were asked to rate the importance according to the seven-point scale, ranging from 1("Least important") to 7 ("Most important"). After indicating their ranking of each of the three

components, respondents were asked to provide any additional components that they thought should be considered in describing learning objects.

Part IV: Utilization of Learning Objects

Part IV was composed of three survey questions on the use of learning objects. This section was designed to collect information regarding the details of how learning objects are used to support instructional design.

Question One: Current Utilization. The analysis of the current literature revealed three themes in the current utilization of learning objects. By capitalizing on the advanced technical features of learning objects, efforts were made to use learning objects to automate the instructional design process (Merrill, 2002; Spector & Ohrazda, 2003). In response to criticism of the automation trend due to the replacement of human instructors and designers by machines, studies were conducted on how to use learning objects to aid instructional designers, developers and instructors (Muzio, Heins, & Mundell, 2002; Recker, Dorward, & Nelson, 2004). Based on different perspectives from these two approaches, with the consideration of learners as active creators of their own learning, suggestions were made to utilize learning objects to empower learners to control their own learning (Collis & Strijker, 2001; McGee, 2006; Tan, Aris, & Abu, 2006).

These three themes were the basis for questions related to current utilization. The respondents were asked to report how they were currently using learning objects by choosing options from the following items: "(a) To automate the instructional design process, (b) To aid instructional designers, developers, and instructors in designing/developing/teaching courses, (c) To empower learners to have more control over their own learning, or (d) None of the above (Please explain)."

Question Two: Design Strategy. In effort to find an effective way to utilize learning objects for learning, researchers have employed various design strategies for learning objects (Kay & Knaack, 2007a; Krauss & Ally, 2005; Lim, Lee, & Richards, 2006; Nugent et al., 2006). While individual studies introduced their own design strategies, there were no agreed-upon formal instructional design strategies on using learning objects. Furthermore, there is a lack of studies exploring how instructional strategies were adopted across varying settings. By further analyzing instructional strategies of existing studies, the study identified instructional strategies that were suggested by educators. These strategies were constructed as items of the survey question on design strategy. The respondents were asked to indicate all the design strategies that they were utilizing in their implementation of learning objects from the items below:

a) Specify learning objectives for individual learning objects
b) Aggregate learning objects in a sequence from lower-order to higher-order learning outcomes
c) Embed feedback functions into learning objects to indicate students' performance
d) Provide concrete, authentic examples and problems
e) Embed interactivity features for learners to provide the solutions to problems presented
f) Encourage students to reflect on their own learning
g) Provide learning strategy support such as self-assessment questions, guides/hints, opportunities to review learning object content, and feedback on responses
h) Provide learner control of the pace and sequence of his or her own learning
i) Other strategies (Please describe other design strategies that you are using which are not listed above)

Question Three: Granularity Level. One of the most important issues in applying learning objects in education is the size of learning objects or their granularity level (Wiley, 2002). Despite current efforts to determine the optimal granularity level (Kay, 2007; Nugent et al., 2006), there is no agreement. At the same time, there is a lack of research exploring how granularity levels are currently being utilized. To provide the knowledge for this topic, the present study attempted to identify the current status of utilizing granularity levels as well as factors to determine the use of preferred granularity level among IDT practitioners. The third question on granularity levels consisted of four sub-questions.

By incorporating multiple granularity levels introduced in the current literature (ADL, 2004; Bannan-Ritland, Dabbagh, & Murphy, 2002; Cisco, 2003), five granularity levels were identified: assets, combined media, one complete instructional unit, lesson or module, and course. The first sub-question asked the respondents to indicate all the sizes of learning objects that they were currently using in their organization. The second sub-question asked respondents to report the size that they used most frequently. The items were the same for both first and second sub-questions as follows:

(a) Asset: Single discrete unit of information, such as text, image, sound, etc.

(b) Combined media: Consists of content and a combination of optional media (image, sound, animation, etc.)

(c) One complete instructional unit: Consists of several media. Can have learning objectives, content, practice, assessment with some media

(d) Module: Consists of several units

(e) Course: Consists of several modules

(f) None of the above (If none of the above describes the size of learning objects that you are using, please describe how your organization defines the parameters of a learning object).

The third sub-question sought data on the reasons for using the granularity level. Studies showed that users of learning objects chose specific granularity levels because of the ease of reusability (Recker, et al., 2006; Wiley, et al., 2000). Some users chose specific granularity levels because those sizes were easy to reuse in different contexts without further customization, while other users chose levels because those sizes were easy to customize for their own instructional contexts. Also, studies showed that the affordances of a learning object system determined the choice of the size of learning objects (Kang, Lim, & Kim, 2004; South & Monson, 2002). The determination of the size of learning objects by Bradley and Boyle (2004) was driven by the consideration of learners, especially the attention span of learners. In addition, educators recommended considering the nature of a learning topic in order to determine the size of learning objects (McGee, 2006; Wiley, et al., 2000). These identified reasons influencing the choice of granularity levels were used as the basis for survey items. Based on their choice of the most frequently used granularity level in the second sub-question, the third sub-question asked the respondents to indicate what made them use that size frequently by choosing options from following reasons:

(a) Easy to reuse in different contexts without further customization

(b) That is the size that the learning object system in our organization affords

(c) That size is optimal for learners, considering attention span

(d) The nature of the learning topic (complexity level)

(e) Easy to customize for my own instructional contexts

(f) Others (Please explain)

Finally, the fourth sub-question was intended to measure the consistency of the use of granularity levels across different projects. This question was added based on the recommendation of the committee members. The addition of this question was expected to provide valuable data on the utilization of granularity levels. Existing studies on granularity levels (Bradley & Boyle, 2004; Lim, Lee, & Richards, 2006; Moisey, Spencer, & Bob, 2006) were based on one single project, failing to provide a broader perspective on granularity levels across multiple projects. Therefore, the findings from this question would fill the research gap in this regard. The fourth question showed respondents the following statement: "I vary the granularity of the learning objects I use across different projects." In response, respondents chose the appropriate point from a seven-point scale, ranging from "strongly disagree" to "strongly agree."

Part V: Perceived Benefits of Learning Objects

Part V was concerned with the perceived benefits of learning objects. To explore the perceived benefits of learning objects, some studies were conducted, mainly focusing on the perceived learning benefits for students and teachers in K-12 settings (Kay, 2007; Kay & Knaack, 2008b). There is a shortage of studies examining the benefits of learning objects to support the instructional design and development process among IDT practitioners in various settings.

Previous studies were analyzed to identify items related to the potential benefits for the current study. The present study considered six important benefits of learning objects: the overall benefit for the instructional design process, reusability, time- and cost-effectiveness, the support for interactivity, and motivation. First of all, as an overarching benefit for IDT practitioners, the

effectiveness of learning objects in supporting instructional design process was chosen as one of the important benefits. There is the lack of research or empirical studies reporting on the overall benefit of learning objects in this regard. Also, while reusability was emphasized as an important benefit of learning objects (Nugent, et al., 2006; Parrish, 2004), there were mixed results on its benefits (McCormick & Li, 2006). Just like reusability, there were mixed reactions to the benefits of time- and cost-saving effects (Christiansen & Anderson, 2004; Kay & Knaack, 2007a). To provide some empirical data to determine benefits, the current study chose reusability and time- and cost-effectiveness as benefits of interests. Finally, as interactivity and motivation features of learning objects were found beneficial for students' learning (Cochrane 2005; McCormick & Li, 2006), these benefits were included. Respondents were asked to rate their perceived benefits of the items below by choosing from a 7-point Likert scale ranging from 1 ("strongly disagree") to 7 ("strongly agree").

(a) Overall benefits: Learning objects are effective in supporting instructional design processes

(b) Motivation: Learning objects are effective in motivating learners

(c) Interactivity: Learning objects are effective in designing interactivity features for the program

(d) Cost: Learning object use decreases the development cost to create a new course

(e) Time: Learning object use decreases the development time to create a new course

(f) Reusability: Learning objects support the reuse of instructional context in flexible ways.

Construct Validity, Expert Review, and Pilot Test

Construct Validity

Some of the survey items were based on existing survey instruments, and previous studies established the face validity of those items. These items included those on adoption status, usage status, and future usage intentions (Ahn et al., 2008; Davis et al., 1989; Liao & Lu, 2007). As an attempt to establish the construct validity of the overall survey instrument, the present study went through three stages in the construct validity process. In the first stage, the survey instrument was reviewed and revised based on the guidance from the dissertation committee, which was comprised of four IDT professors at Virginia Tech. The details on the survey instrument as the result of the first stage were explained in the previous section on the instrument. In the second stage, the survey went through an expert review. In the third stage, the survey was pilot-tested by experienced users of learning objects.

Expert Review

The expert review was conducted with IDT experts who were experienced at using learning objects and/or the survey instrument. Three experts included Dr. David Halpin of Certified Medical Representatives (CMR) Institute in Roanoke, VA, Dr. Randy Hollandsworth of Piedmont College, Athens, GA, and Dr. Todd Ogle of Virginia Tech. Under the guidance of Dr. Barbara Lockee, the dissertation committee chair, the survey was further modified based on the recommendations of these experts. The finalized survey, reflecting the expert review, is included as Appendix B.

Part I: Background Information. Part one consisted of five questions to gather background information on participants and their organizations. Out of these five questions, one change was made in question three on the job role of the respondents. The third item of question three was changed from “professor” to “faculty.”

Part II: Adoption Status of Learning Objects. Part Two consisted of five questions under the headings of adoption status, intentions to use, actual use, project-based use, and adoption status. All of five questions were changed as a result of the expert review.

Items in question One were changed. The subject "my organization" was added to the beginning of each item, except the item "not familiar with learning objects." The item "have heard, seen, or read about learning objects, but likely won't use" was replaced by "my organization is not using learning objects." Also, the order of the items was revised. As a result, the final form of the items in question one were as follows: "(a) My organization is currently using learning objects, (b) My organization is seeking additional information and/or exploring implementation of learning objects, (c) My organization is not using learning objects, and (d) Not familiar with learning objects."

Questions Two and Three were also changed. In question two on intentions to use, the scale was changed from seven to five points. "Don't know" was added as another option at the end of the five-point scale. In question three on actual use, "In your professional role" was added at the beginning of the instruction. Question three instruction read as "In your professional role, please indicate your current level of usage of learning objects."

Question Four on project-based use was also changed. The item "None of the above/Not applicable" was replaced by "Do not currently use learning objects." The percentages listed were modified to avoid overlaps. Thus, the items of question four were categorized as "(a) less than 25% of my projects, (b) 25%-49% of my projects, (c) 50%-74% of my projects, (d) 75%-99% of my projects, (e) 100% of my projects, and (f) Do not currently use learning objects."

Question Five on adoption factors was comprised of three sub-questions on perceived ease of use, perceived usefulness and additional factors. The first two sub-questions were

modified. The orders of these sub-questions of question five were changed by having the sub-question “perceived ease of use” precede the sub-question “perceived usefulness.” By changing the tense from future to present tense, the items of the first sub-question were changed. The item “Using learning objects improves my teaching/developing performance” was deleted. As a result, the items of the first sub-question read as follows: “(a) Using learning objects makes it easier to design, develop, and teach course content, (b) Using learning objects enhances my effectiveness in designing, developing, and teaching (c) Using learning objects increases my designing/developing/teaching productivity, (d) Using learning objects helps me to accomplish designing/developing/teaching tasks more quickly, and (e) Learning objects are useful in my designing/developing/teaching.”

The second sub-question on perceived ease incorporated a tense change from future tense to past tense, resulting in “(a) Learning to use learning objects was easy for me, (b) I find it easy to get learning objects to do what I want them to do, (c) My interaction with learning objects is clear and understandable, (d) I find learning objects flexible to interact with, (e) It is easy for me to become skillful at using learning objects, and (f) I find learning objects easy to use.” The third sub-question changed from “None of the Above (Please explain.)” to “Other Reasons (i.e. your organization requires the use of learning objects).”

Part III: Definitions of Learning Objects. Part Three consisted of two questions. Question One explored the focus of the definition of learning objects based on three options: technical aspects, learning aspects, and the combination of both. Following this, question two investigated perceived importance of three components: digital resource, reusability characteristics, and educational purpose. Also, Question Two asked respondents to describe other components that needed to be included in addition to these three components.

Question One on focus was modified by changing the wording of the third item. “The” was replaced by “a,” resulting in “A combination of the both.” In Question Two on the three components of the definition, the scale was changed from seven to five points. Also, the wording of the third component was changed from “educational purpose” to “instructional support.” The sub-question that explored other components was changed by adding the examples in the parentheses, resulting in “What other components should be considered when describing learning objects? (i.e. Small size, self-contained, metadata tagging, scalability).”

Part IV. Utilization of Learning Objects. At the beginning of Part IV, an instruction was added, stating “These items assume that you are currently using learning objects.” Part IV was comprised of three questions which examined current utilization, design strategies, and granularity levels. The changes were reflected in question two on design strategies, and question three on granularity levels. The four sub-questions of question three were changed as well.

The items of question Two on design strategies underwent changes. The wording of the first item at the beginning of the sentence was changed from “Specify” to “Create,” reading as “Create learning objectives for individual learning objects.” One item, “Provide learner control of the pace and sequence of their own learning,” was deleted.

Question Three on granularity levels was changed. The first and second sub-questions were changed in terms of the wording of the third granularity level, “unit.” The wording changes included the replacement of “can have” with “might include” as well as altering “with medias” to “and additional media.” The unit, the third item of both the first and second sub-questions, was finally described as “Might include learning objectives, content, practice, assessment, and additional media.”

The third sub-question on the granularity levels had an item change as well. The first item was changed by deleting "without further customization" at the end and was finalized as "Easy to reuse in different contexts." The second item incorporated some additional words, such as "minimal" and "content delivery system," and was finalized as "That is the minimal size that learning object system (content delivery system) in our organization affords." One item, "That size is optimal for our learners considering their attention span," was deleted.

The wording of the fourth sub-question for the third question was changed from "amount of using different granularity levels across" to "granularity of the learning objects I use across different", reading as "I vary the granularity of the learning objects I use across different projects." Also, the scale was changed from a seven-point scale to a five-point scale, ranging from 1 as "rarely" and 5 as "often."

Part V: Perceived Benefits of Learning Objects. Part V asked respondents to rate the benefits of using learning objects. The scale for the Part V questions was changed from a seven-point to a five-point scale and included N/A, in addition to the five-point scale.

Pilot Test

The online version of the survey, which went through two previous validation stages, was pilot-tested for further refinement. The five participants for the pilot test were recruited from the Advanced Distributed Learning (ADL) Initiative, which developed the specifications for the Shareable Content Object Reference Model (SCORM), and CMR Institute, which develops online courses using learning objects. These participants included experts on learning objects at ADL and experienced instructional designers of learning objects at CMR Institute.

At the beginning of the pilot test, some errors were detected. These errors had occurred during the conversion process of the survey from the paper-based version to the online version.

Typographical errors were corrected. A logic problem was detected when calculating respondents' experience of learning objects from the background information section. The specific summation number of respondent's experience was wrongly specified by the logic of the online survey administration. By modifying the logic of the online survey, the problem with the experience question was fixed. Then, the pilot test was resumed. Without further problems, participants completed the survey. On the average, it took about 10 minutes for participants to complete the survey.

Data Collection

Prior to data collection, IRB approval was sought, as the present study involved human participants. The study was approved by IRB# 09-637 of Virginia Polytechnic Institute and State University (See Appendix C). According to IRB research protocol instructions of the Virginia Polytechnic Institute and State University, a signed consent form was not needed for survey participants of the current study. However, participants were provided with the consent information before filling out the survey as requested by IRB protocol instructions. When participants did not wish to participate in the study, they opted out by exiting the survey website prior to the start of the survey.

Sampling and Implementation

The purpose of the study was to explore the perceptions and actual use of learning objects among IDT practitioners across various organizations. Therefore, the participants of the present study were IDT practitioners who are currently using learning objects across various organizations, including higher education, business, K-12, government, and military. In addition, as the participants, the present study targeted active IDT practitioners who have membership in various IDT professional organizations. To estimate the population size, the researcher first

calculated the total number of IDT practitioners across various organizations, based on the membership numbers of IDT professional organizations.

IDT practitioners across various organizations were tracked via well-known IDT professional organizations, which include: the American Society for Training and Development (ASTD) and the International Society for Performance Improvement (ISPI), which represent the corporate sector; the Association for Educational Communications and Technology (AECT), which represents higher education; and the International Society for Technology in Education (ISTE) and the Association for the Advancement of Computing in Education (AACE), which represent K-12. The total membership of the organizations was about 75,000, determined by combining the number of members of these organizations: about 2,000 AECT members (AECT, 2009); about 40,000 ASTD members (ASTD, 2009); about 10,000 ISPI members (ISPI, 2009); about 5,960 AACE (AACE, 2009); about 18,000 ISTE members (ISTE, 2009). By adding up these membership numbers, total number of IDT practitioners across various organizations was estimated at 75,000. However, this total number might not represent distinct individuals, as IDT practitioners might belong to multiple organizations. The total number of IDT practitioners ranges from 25,000 to 37,500, assuming that individual IDT practitioners have membership in two to three organizations.

To access IDT practitioners in these organizations, the researcher utilized three methods: contacting the organizations, contacting individual members in the organizations, and snowball sampling. The present study utilized multiple methods to increase the response rate as high non-response rate has been of concern among survey researchers (Deutskens, de Ruyter, Wetzels, & Oosterveld, 2004). Andrews, Nonnecke, and Preece (2003) mentioned that a 20% or lower response rate was common as an e-mail response rate. Pershing, Ryan, Harlin, and Hammond

(2006) reported a 12.2% response rate when administering an online AECT membership survey by e-mailing AECT members.

First, via e-mail and/or phone, the researcher contacted various organizations about the possibility of advertising the survey instrument to their members. The researcher communicated not only with the above-mentioned organizations such as ASTD, ISPI, ISTE, and AACE, but also with other organizations including E-Learning Guild, the American Association of Community Colleges (AACC) and the Advanced Distributed Learning (ADL) Initiative.

In addition to contacting the presidents and/or representatives of these organizations, the researcher contacted individual members of the organizations. By searching through the homepages of IDT professional organizations and participant/presenter lists from conferences hosted by IDT professional organizations, the researcher could obtain individual contact information for members of ASTD, ISPI, ISTE, AACE, AACC, ADL, and E-Learning Guild. Also, the researcher could procure the contact list of many IDT practitioners in higher education based on the participant list of the 25th Annual Conference on Distance Teaching and Learning (DTL).

Thirdly, the current study utilized the snowball sampling method to locate users of learning objects among IDT practitioners. Snowball sampling is a chain-referral sampling method to reach the target population by utilizing social networks of identified participants (Colman, 2006). Researchers get the contact information of other participants from existing participants of the sample until researchers acquire a large enough sample size for their studies (Salganik & Heckathorn, 2004). Snowball sampling was appropriate for this study as this kind of sampling is often used when the purpose of the study is descriptive and explorative, as cited by Hendricks, Blanken, and Adriaans in 1992 (Faugier & Sargeant, 1997). While

communicating with individual IDT professionals, the researcher solicited the contact information of other IDT professionals who are currently using learning objects. As a result, the researcher could identify more participants, such as professors in universities and community colleges, members in MERLOT (Multimedia Educational Resource for Learning and Online Teaching), government officers in ADL and Centers of Disease Control (CDC).

As a result of contacting various organizations, the survey was advertized to AACC members via the AACC research department. Also, the survey was posted on the online bulletin board of Learning Town, a social network for IDT professionals, which was hosted by Elliott Masie of MASIE center (LearningTown, 2009). Based on the contact information resulting from individual contacts and snowball sampling, the survey invitation letter was sent out to individual IDT professionals (Appendix D). The invitation letter was followed by a reminder message to these individual IDT professionals. A follow-up was recommended for the survey by educators. Based on various studies on follow-ups, Deutskens, de Ruyter, Wetzels, and Oosterveld (2004) concluded that even a single follow-up would increase the response rate.

Because it is not possible to estimate how many AACC and LearningTown members were aware of the online survey, as it is administered to all members rather than individual members, the present study calculated the response rate based on the individual contact results. Excluding e-mails that were returned to the researcher, 1,000 individual IDT practitioners were contacted by the researcher. Out of 1,000 individuals, 212 participated in the survey. Among 212 responses, 21 responses were invalid, as these responses provided only the demographic information. Therefore, the response rate of the study is calculated as 19.1%. The total of 191 responses exceeds 100 responses, which Fraenkel & Wallen (2006) recommended as the minimum number of participants for descriptive studies. The response rate – 19.1% - fell within

the response rate range of existing studies related to online surveys, which ranges from 12.2% to 20% (Andrews, Nonnecke, & Preece, 2003; Pershing, Ryan, Harlin, & Hammond, 2006).

Data Analysis Procedures

This study utilized descriptive studies which incorporated elements from both quantitative and qualitative research methodologies. Therefore, depending on type of the data, quantitative or qualitative analysis was conducted. A summary of the research questions and data analysis in relation to specific survey items is presented in Appendix A.

To analyze the data on most of the research questions, quantitative methods were used. Specifically, the responses of participants were analyzed using descriptive statistics. Descriptive statistics were suitable as they are used to describe the data instead of making inferences (Howell, 2002). The current study utilized measures of central tendency, such as the mean and frequency, to explore the actual use of learning objects across various organizations.

The responses to open-ended questions were analyzed by utilizing qualitative methods. For example, by analyzing comments on the descriptions of learning objects, components of learning objects were identified from each comment. At the same time, components mingled with other components were separated into discrete ones. By grouping these components, common themes were identified. Once common themes emerged, responses of respondents were categorized by theme (Fraenkel & Wallen, 2005; Leedy & Ormrod, 2005; Rossman & Rallis, 2002). By examining the categorization of themes and responses, the relationships between themes and/or responses were constructed.

Chapter Four: Results

Based on the data collection process delineated in previous methodology chapter, the present study collected the data from IDT practitioners across various organizations in higher education, business, government, and K-12. Chapter Four presents survey responses of these IDT practitioners. Along with the background information of participants, this chapter provides the study's findings on four research questions, namely the definition, current utilization, perceived benefits, and adoption status of learning objects.

Survey Response

In total, 212 IDT practitioners participated in the study. However, out of 212 responses, 21 responses were excluded as these responses included only background information of respondents such as their job role, their practice years, their experience with learning objects and the information on their organizations. Therefore, the present study included only valid 191 responses and reports the analysis results based on these 191 responses.

Background Information

This section presents the background information of 191 participants in the study. The largest group of participants represented higher education (51%, *n*=96), followed by industry/business (22%, *n*=41). Next to these organizations, the same proportion of participants (8%, *n*=15) came from either military/government or community college. The remaining participants represented K-12 (5%, *n*=10), Non-profit (5%, *n*=9) or others (2%, *n*=4). Other organizational types included private, for profit graduate college of Oriental Medicine, Health Care, and a retired university professor.

Many respondents belonged to the organizations that have more than 200 employees (69%, *n*=130). Out of 191 respondents, 57% of respondents (*n*=107) worked for the

organizations which have more than 500 employees. The similar proportion (11%) of participants belonged to the organizations either with 50-199 employees (*n*=21) or 10-49 employees (*n*=20). The remaining participants (9%, *n*=17) belonged to the organizations which have less than 10 employees.

The most-represented vocational role among participants was faculty (26%, *n*=50). After faculty, the same proportion of participants (18%, *n*=34) were either instructional designers/developers or distance education/eLearning program administrators. Less than 10 % of participants were consultants (9%, *n*=17) or instructors/trainers (6%, *n*=12). The rest of the participants were Human Performance Improvement (HPI) specialists (4%, *n*=8), teachers, technology coordinators, or librarian/information specialists. Other jobs represented included educational technologist, E-Dean of Virtual college, faculty support services, marketing manager for higher education, vice president of educational services, standards specialist, and director of Distance Education and Instructional Technology.

Sixty seven percent of the participants were found to be engaged in designing, developing, and/or delivering instruction for more than 10 years. Thirty four percent of all participants had more than 20 years of professional practice. The average length of time that respondents had worked with learning objects was about seven years.

Table 3: Background Information

Organization Type	Higher education	Community college	Industry/ business	Military/ government	K-12	Non-profit	Other
	96 (51%)	15 (8%)	41 (22%)	15 (8%)	10 (5%)	9 (5%)	4 (2%)
Employee #	1-9	10-19	20-49	50-99	100-199	200-499	Over 500
	17 (9%)	9 (5%)	11 (6%)	8 (4%)	13 (7%)	23 (12%)	107 (57%)
Job role	Instructional Designer/ Developer	Instructor/ Trainer	Faculty	HPI Specialist	Distance Education Administrator	Consultant	
	34 (18%)	12 (6%)	50 (26%)	8 (4%)	34 (18%)	17 (9%)	
	Instructional Systems Specialist	Teacher	Librarian/ Information Specialist	Technology Coordinator	Other or N/A		
	4 (2%)	8 (4%)	2 (1%)	5 (3%)	17 (9%)		
Practice yrs	0-3	4-6	7-10	11-14	15-20	Over 20	
	11 (6%)	20 (11%)	30 (16%)	25 (15%)	34 (18%)	64 (34%)	
LO Experience	Response Average						
	7.09 Years						

Note: ( ) indicate response frequency

Definition of Learning Objects

The first research question explored the current conceptualization of learning objects among IDT practitioners. In this section, IDT professionals were asked to indicate their conceptualization of learning objects. This section is comprised of two items: the focus and the components of the definition of learning objects.

Question One asked respondents to indicate the ideal focus of the definition of learning objects. Out of 188 respondents who answered this question, the largest proportion of respondents (61.7%, *n* =116) thought that the focus should be on a combination of technical and learning aspects. Following this, about one third of respondents (29.8%, *n* =56) thought that learning aspects should be the focus. Therefore, learning aspects were emphasized by respondents based on participants' choice for these two options compared with 3.2% (*n* =6) of participants who chose technical aspects. For other foci than technical and/or learning aspects,

participants (*n*=10) mentioned desiring outcome/mission orientation and measurable outcome aspects, on which they further elaborated from the learning perspective.

Table 4: The Focus of the Definition

	Percent	Frequency
Technical aspects	3.2%	6
Learning aspects	29.8%	56
A combination of both	61.7%	116
None of the above	5.3%	10
Total	100%	188

Participants across multiple organizations indicated that the focus of the definition of learning objects should be on the combination of technical and learning aspects. A similar trend was detected across different sectors, except K-12. Respondents in K-12 emphasized learning aspects in defining learning objects.

Table 5: The Focus of the Definition Across Different Organizations

	Percent (Frequency)					
	Higher ed	Com.collg	Industry	Military	K-12	Non-Profit
Technical aspects	3.2% (3)	0% (0)	5.0% (2)	6.7% (1)	0% (0)	0% (0)
Learning aspects	29.5% (28)	33.3% (5)	20.0% (8)	33.3% (5)	**60.0% (6)**	22.2% (2)
A combination of both	**58.9% (56)**	**66.7% (10)**	**72.5% (29**)	**53.3% (8)**	40.0% (4)	**77.8 (7)**
None of the above	8.4% (8)	0% (0)	2.5% (1)	6.7% (1)	0% (0)	0% (0)

Question Two asked respondents to rate the perceived importance of three components: digital resource, reusability characteristics, and instructional support. Out of these three components, reusability characteristics were most valued by respondents. Respondents rated each component on a scale of 1 to 5, where 1 was least important and 5 was most important. Eighty one % (*n*=149) of respondents, among 185 participants who responded to the question about the importance of reusability, marked either 4 or 5. Generally, respondents were positive about the importance of reusability (M = 4.17, SD =0.90). As with reusability characteristics,

many of the respondents (77.7%, *n*=143) expressed the importance of instructional support by rating it either 4 or 5 in importance (*M* = 4.10, *SD*=0.89).

Compared with the preceding two components, fewer respondents (58.7%, *n*=108) indicated the importance of digital resource component, taking together 4 or 5. The mean of digital resource was 3.53 (*SD*=1.08), indicating that on the average respondents thought that digital resource was somewhat less important than two other components.

Table 6. Three Components

	1. Least Important	2	3	4	5. Most Important	Mean (SD)
Digital resource	7.6% (14)	6.5% (12)	27.2% (50)	42.9% (73)	15.8% (29)	3.53 (1.08)
Reusability	1.6% (3)	3.3% (6)	14.1% (26)	38.6% (71)	42.4% (78)	4.17 (0.90)
Instructional support	1.6% (3)	2.2% (4)	18.5% (34)	40.2% (74)	37.5% (69)	4.10 (0.89)

Note: ( ) indicate frequency

The results from all participants showed that they valued reusability and instructional support with the mean greater than 4. The same results were found among participants in higher education, community colleges, industry/business and military/government organizations. However, some difference was noted in K-12 and non-profit organizations. In K-12, these three components were highly regarded, with all three having a mean greater than 4. In non-profit organizations, reusability was the only component with a mean is greater than 4.

Table7. Three Components Across Different Organizations

	Mean (SD)					
	Higher ed	Com. collg	Industry	Military	K-12	Non-Profit
Digital resource	3.54 (1.16)	3.67 (0.82)	3.25 (1.19)	3.60 (0.51)	**4.10 (0.57)**	3.44 (1.13)
Reusability	**4.15 (0.93)**	**4.14 (0.77)**	**4.13 (0.99)**	**4.33 (0.72)**	**4.00 (1.05)**	**4.22 (0.83)**
Instructional support	**4.20 (0.88)**	**4.07 (0.83)**	**4.08 (0.92)**	**4.00 (0.65)**	**4.20 (0.63)**	3.67 (1.12)

Participants were also asked to provide other potential features that describe learning objects. In response, 73 participants provided their own answers. Through the analysis of comments of these participants, components were identified in comments. At the same time,

components that were mingled with other components in the comments were separated into discrete ones. By grouping these components, three major categories have appeared: technical, learning, and ownership.

First, among many of IDT practitioners, technical aspects were evidently important in conceptualizing learning objects (*n*=53), showing the focus on reusability. In addition to the key technical component of reusability, important components included metadata tagging (*n*=13), self-containment (*n*=12), and granularity (*n*=11). The review of these three components revealed their relation to reusability. In order for learning objects to be reusable, learning objects need to be meta-tagged so that stored learning objects can be searched based on the meta-data information. Also, when learning objects are self-contained, they can be separated and combined as needed.

Additionally, participants listed re-purposeability (*n*=6), interoperability (*n*=6), scalability (*n*=5), availability (*n*=5), accessibility (*n*=3), and standards-compliance (*n*=3). These components are also related to reusability. To be reusable, learning objects should be easily modified for different purposes and interoperable across multiple platforms and operating systems. By reusing available and accessible learning objects in the repository, instructional designers can create courses easily. Also, to make learning objects reusable across various organizations, learning objects need to be developed in compliance with standards such as SCORM.

Second, to effectively provide instructional support, learning objects should focus on learning and consist of instructional components. As a way to further elaborate on learning aspects, participants emphasized the instructional focus of learning objects (*n*=6). This focus was consistent with researchers who attempted to define learning objects by emphasizing the learning perspective (Cochrane, 2005; Mavrommatis, 2008; Wiley 2000). From this perspective, as

specific learning components, participants included learning objectives (*n*=3), content (*n*=3), assessment (*n*=2), learning outcomes (*n*=2), and instructional strategies to engage learners (*n*=2). These components that participants provided were aligned with components that researchers have identified as an attempt to conceptualize learning objects that optimizes learning effectiveness. These researchers included content (Lim, Lee, & Richards, 2006), assessment (Nugent, Soh, & Samal, 2006), learning outcomes (Jonassen & Churchill, 2004), and instructional strategies to engage learners (Kay, 2007).

Third, in addition to technical and learning components, participants (*n*=7) emphasized the ownership component of learning objects by discussing copyright issues. There has been a lack of research to conceptualize learning objects from this perspective. However, it is worthwhile to consider this component, as it may solve some issues of learning objects. Learning objects were applauded by researchers as they expected that they would enable a new economy in education where instruction would be easily created and freely shared across many organizations (Collis & Strijker, 2001). However, people might not be willing to freely share their learning objects because of copyright issues (Parrish, 2004). As suggested by participants, if learning objects incorporate some ability to protect intellectual property rights, sharing will be further promoted, leading to a new economy in education.

Table 8. Other Components

Categories	Components (73)		
Technical (53)	Metadata tagging (13)	Self-contained (12)	Granularity (11)
	Re-purposeability (6)	Interoperability (6)	Scalability (5)
	Availability (5)	Accessibility (3)	Standards compliant (3)
Learning (18)	Instructional focus (6)	Learning objective (3)	Content (3)
	Assessment (2)	Learning outcomes (2)	Engagement (2)
Ownership (7)	Copyright (7)		

Note: ( ) indicate frequency

Current Utilization

The second research question examined how IDT practitioners were currently utilizing learning objects. Particularly, IDT practitioners were asked to indicate their use of design strategies and granularity levels. Survey Question One, Two and Three from Part Four dealt with the second research question.

Survey Question One asked for participants' current utilization status of learning objects out of three options. A large proportion of responses (60.2%, *n*=97) showed that the use of learning objects to empower learners to have more control over their own learning. Next to learner control, slightly less than the half (49.1%, *n*=79) revealed the use of learning objects to aid instructional designers, developers, and instructors. A smaller portion of responses (20.5%, *n*=33) showed their use of learning objects for the purpose of automating the instructional design process. Out of 161 responses for this item, most (86.1%, *n*=138) were utilizing at least one of these three options, but a small portion (14.3%, *n* = 23) were utilizing none. Out of the remaining 23, eight respondents were either not currently using learning objects or were not sure if they used learning objects. The remaining valid participants recorded their use of learning objects to supplement course instruction, to support the standards, and to do learning modules in a variety of ways throughout the consortium.

Table 9. Current Utilization

Utilization	Percent (Frequency)
To automate the instructional design process	20.5% (33)
To aid instructional designers, developers, and instructors	49.1% (79)
To empower learners	**60.2% (97)**
None of the above	14.3% (23)
Total	100% (161)

The overall results showed the prevalent use of learning objects to empower learners. Similar results were found among respondents from the higher education, community college, K-12, and non-profit sectors. However, respondents from industry and military backgrounds revealed that their frequent use of learning objects was related to aiding instructional designers and developers.

Table 10. Current Utilization Across Different Organizations

	Percent (Frequency)					
	Higher ed	Com. Collg	Industry	Military	K-12	Non-Profit
Automation	12% (14)	13% (3)	17% (9)	7.7% (1)	23.1% (3)	11.1% (1)
IDT personnel	35% (39)	34.8% (8)	**39.6% (21)**	**38.5% (5)**	23.1% (3)	22.2% (2)
Learners	**43% (49)**	**52.2% (12)**	34% (18)	23.1% (3)	**53.8% (7)**	**44.4% (4)**
Others	10% (11)	0% (0)	9.4% (5)	30.8% (4)	0% (0)	22.2% (2)

Design Strategies

The second question asked participants to report design strategies that they were using in their implementation of learning objects. Out of example design strategies, the most frequently utilized strategy was to provide concrete, authentic examples and problems; 73.9% (*n*=113) accounted for this choice. The next frequently utilized strategies were providing learning strategy support such as self-assessment questions, guides/hints, and opportunities to review learning object content (60.1%, *n*=92) and creating learning objectives for individual learning objects (55.6%, *n*=85). Strategies that about half of participants frequently chose included the encouragement of students to reflect on their own learning (50.3%, *n*=77) and the embedding of interactivity features for learners to provide the solutions to problems presented (49.7%, *n*=76).

At less frequent levels, participants were found to embed feedback functions to indicate students' performance (41.8%, *n*=64). Out of example design strategies, the least utilized strategy was the aggregation of learning objects in sequence from lower order to higher order

learning outcomes (31.4%, *n*=48). Out of total 153 respondents of this question, most of respondents (88.2%, *n*=135) were utilizing at least one of these example design strategies.

A small portion of respondents (11.8%, *n* = 18) indicated that they were using other design strategies than these seven example strategies. There were two invalid responses, one of which showed no use of learning objects and the other showed the comments on the aggregation sequence from lower order to higher order learning outcomes. Remaining valid data showed participants utilized avatars, Personal Learning Environments (PLE), various media including audio and video, and collaboration features.

Table 11. Design Strategies

Strategies	Percent	Strategies	Percent
Learning objectives	55.6% (85)	Aggregation	31.4% (48)
Feedback functions	41.8% (64)	Concrete, authentic examples	73.9% (113)
Interactivity	49.7% (76)	Reflection	50.3% (77)
Learning strategy support	60.1% (92)	Others	11.8% (18)
Total Response (153)			

Note: ( ) indicate frequency

Different sectors showed the differential use of instructional strategies. The instructional strategies used by more than 15% of responses across different sections were explored. In higher education and industry, participants preferred to use individual learning objects to create learning objectives, to provide concrete and authentic examples, and to provide learning strategy support. In community colleges, K-12 and non-profit organizations, participants were found to utilize learning objects to provide concrete examples, and the reflection opportunities, and to create learning objectives. In the military, preferred instructional strategies include learning strategy support and the features to support interactivity.

Table 12. Design Strategies across Different Organizations

	Percent (Frequency)					
	Higher ed	Com. collg	Industry	Military	K-12	Non-Profit
Learning objectives	**15% (40)**	**13.2% (7)**	**16.5% (21)**	12.2% (5)	**21.2% (7)**	**18.2% (4)**
Aggregation	8% (21)	7.5% (4)	10.2% (13)	9.8% (4)	6.1% (2)	9.1% (2)
Feedback functions	12% (32)	11.3% (6)	11.8% (15)	14.6% (6)	6.1% (2)	9.1% (2)
Concrete examples	**21% (57)**	**18.9% (10)**	**18.1% (23)**	14.6% (6)	**21.2% (7)**	**27.3% (6)**
Interactivity	14% (38)	11.3% (6)	14.2% (18)	**17.1% (7)**	12.1% (4)	4.5% (1)
Reflections	13% (36)	**17.0% (9)**	10.2% (13)	9.8% (4)	**24.2% (8)**	**18.2% (4)**
Learning strategy support	**16% (45)**	4% (11)	**18.9% (24)**	**19.5% (8)**	9.1% (3)	4.5% (1)
Others	2% (6)	0% (0)	0% (0)	2.4% (1)	0% (0)	9.1% (2)

Granularity Levels

This subsection of the survey explored the current utilization status of granularity levels. This section consisted of four questions, which examined all granularity levels that were used and the most frequently used level. The remaining questions asked participants to indicate the reasons for the usage of granularity levels and their varying use of the granularity levels.

Question One asked participants to choose all granularity levels that they were using, out of five levels, which were asset, combined-media, one-instructional-unit, module, and course. All of these five granularity levels were found to be utilized (92.8%, n = 142), while only about 7.2% (n=11) participants chose none. Combined-media was the granularity level which was used by the highest proportion of responses (69.3%, n =106). Slightly more than half of responses revealed the use of asset (56.9%, n =87) and one-instructional-unit (54.9%, n =84). Compared with these three levels, fewer responses revealed the use of higher levels of learning objects (module: 41.2%, n=63; course: 40.5%, n=62). Out of 11 responses on other parameters of learning objects, three responses indicated no use of learning objects, while four respondents were not sure. One participant explained parameters of his or her organization, which was comprised of units, module, and course without using assets. Two participants showed that they

used a little bit of every level. One participant indicated the components of the instructional unit such as introduction or example were utilized. Survey participants did not reveal other parameters of learning objects that were utilized than these five granularity levels.

Question Two asked participants to choose the size of learning objects that they used most frequently. Out of five granularity levels, the most frequently used level was combined-media which was chosen by 38.2% (*n*=58). This result was consistent with the previous question result, showing that combined-media was used by highest portion of participants (69.3%) out of five levels. The next most frequently utilized levels were asset (18.4%, *n* =28) and one-instructional-unit (17.8%, *n* =27). The less frequently used levels were course (11.2%, *n*=17), with module as the least used level (9.9%, *n*=15). The data from seven participants did not reveal different parameters of learning objects. Four of them said that they were not using learning objects while one could not judge the frequency. The rest of the participants showed other reasons for choosing the frequent granularity level such as templates that incorporate pre-determined levels of granularity or explained the details of the instructional unit that they frequently used.

Table 13. The Utilization of Granularity Levels

Granularity levels	Current Use	Most Frequent Use
Asset	54.9% (84)	18.4 (28)
Combined media	**69.3% (106)**	**38.2% (58)**
Unit	56.9% (87)	17.8% (27)
Module	41.2% (63)	9.9% (15)
Course	40.5% (62)	11.2% (17)
None of the above	7.2% (11)	4.6% (7)
Total Response	100% (153)	100% (152)

Note: ( ) indicate frequency

All five granularity levels were found to be utilized across different organizations. However, in terms of the most frequently utilized level, organizations revealed different results. Participants in higher education, community colleges, industry and K-12 chose combined media

as the most frequently used level, just like the overall results. However, participants in military/government organizations chose the asset, while participants in non-profit organizations chose the module.

Table 14. The Utilization of Granularity Levels

Utilized levels	Percent (Frequency)					
	Higher ed	Com. collg	Industry	Military	K-12	Non-Profit
Asset	21% (43)	21.4% (6)	16.1% (15)	22.9% (8)	27.3% (6)	17.6% (3)
Combined media	26% (54)	32.1% (9)	23.7% (22)	20.0% (7)	36.4% (8)	29.4% (5)
Unit	21% (44)	21.4% (6)	22.6% (21)	22.9% (8)	18.2% (4)	17.6% (3)
Module	15% (31)	17.9% (5)	17.2% (16)	17.1% (6)	4.5% (1)	17.6% (3)
Course	14% (28)	7.1% (2)	29.4% (18)	17.1% (6)	13.6% (3)	11.8% (2)
None	2% (5)	0% (0)	1.1% (1)	0% (0)	0% (0)	5.9% (1)
The most frequent level	Percent (Frequency)					
	Higher ed	Com. collg	Industry	Military	K-12	Non-Profit
Asset	17.1% (13)	15.4% (2)	15.6% (5)	**33.3% (4)**	33.3% (3)	16.7% (1)
Combined media	**40.8% (31)**	**53.8% (7)**	**40.6% (13)**	8.3% (1)	**44.4% (4)**	16.7% (1)
Unit	19.7% (15)	30.8% (4)	12.5% (4)	16.7% (2)	11.1% (1)	16.7% (1)
Module	5.3% (4)	0% (0)	15.6% (5)	25.0% (3)	0% (0)	**33.3% (2)**
Course	10.5% (8)	0% (0)	9.4% (3)	16.7% (2)	11.1% (1)	16.7% (1)
None	6.6% (5)	0% (0)	6.3% (2)	0% (0)	0% (0)	0% (0)

Question Three asked respondents to indicate the reason why they chose the granularity level that they revealed as their most frequently utilized level, in response to question two. A large portion of participants (49.7%, *n* = 75) explained that that level was easy to be reused in different contexts. Also, a similar portion of participants (49%, *n* = 74) chose the granularity level according to the nature of the learning topic. Also, when participants found the granularity level easy to customize for their own instructional contexts, they used that level frequently (39.1%, *n*=59). Compared with these three reasons, a smaller group of participants chose the affordability of the learning object system as reasons for the frequent usage of the granularity level (9.3%, *n* =14).

For other reasons, one participant mentioned that the learning objectives drove the frequent usage of a specific level, which is related to the above option on the nature of the learning topic. Some participants accounted for other external factors. For example, the faculty requested the staff to use a certain size to build courses. Also, because of bandwidth issues and the availability of existing learning objects, participants used certain levels.

Question Four asked participants to rate the consistency of their use of granularity levels across projects. A total of 143 participants rated the consistency on a scale 1 to 5, where 1 was rarely and 5 was often. The highest proportion (42.7%, *n*=61) of participants varied the granularity levels across projects. Generally, participants varied the granularity of the learning objects across different projects, neither rarely nor often (*M*=3.01, *SD*=1.08).

Table 15: Usage Reasons and Consistency

Reasons	Response Percent (Frequency)
Easy to reuse in different contexts	**49.7% (75)**
That is the minimal size that learning object system affords	10.6% (16)
The nature of the learning topic (complexity level)	49.0% (74)
Easy to customize for my own instructional contexts	39.1% (59)
Other Reasons	9.3% (14)
Total	100% (151)

Consistency	1. Rarely	2	3	4	5. Often	Mean (SD)	Total
The use of granularity levels	11.2% (16)	15.4% (22)	42.7% (61)	22.4% (32)	8.4% (12)	3.01 (1.08)	143

A large proportion of participants in all organizations revealed that the level was easy to reuse and that they chose that level according to the nature of the learning topic. Many participants in community colleges, industry, military and non-profit organizations revealed the same usage reasons. However, participants in higher education and K-12 explained that the level was easy to customize, in addition to the nature of the learning topic and the ease of reuse.

In terms of the consistency of varying the granularity levels, the overall results showed that participants varied granularity levels across different projects. Participants in higher education, industry, and K-12 varied granularity levels as much as the overall result. However a difference was noted among respondents in community college, military, and non-profit organizations, as these respondents varied levels less than the overall result: Non¬-profit organizations (M= 2.50); military/government (M= 2.70); community college (M= 2.77).

Table 16: Usage Reasons and Consistency across Different Organizations

Reasons	Percent (Frequency)					
	Higher ed	Com. collg	Industry	Military	K-12	Non-Profit
Easy to reuse	27.8% (32)	**37.5% (9)**	**28.8% (15)**	**35.7% (5)**	**33.3% (5)**	**50% (5)**
Learning object system	7% (8)	4.2% (1)	9.6% (5)	7.1% (1)	6.7% (1)	0% (0)
Learning topic	**33% (38)**	**29.2% (7)**	**36.5% (19)**	**21.4% (3)**	26.7% (4)	**30% (3)**
Easy to customize	**30.4% (35)**	20.8% (5)	17.3% (9)	14.3% (2)	**33.3% (5)**	20% (2)
Others	1.7% (2)	8.3% (2)	7.7% (4)	21.4%(3)	0% (0)	0% (0)
Consistency	Mean (SD)					
	Higher ed	Com. Collg	Industry	Military	K-12	Non-Profit
Level consistency	3.04 (1.04)	2.77 (1.01)	3.07 (1.17)	2.70 (1.06)	3.25 (1.16)	2.50 (1.22)

Perceived Benefits

Third research question examined how IDT practitioners perceived benefits of learning objects. The survey question from Part 5 investigated the third research question.

In this section, participants were asked to indicate their views on the benefits of learning objects in terms of overall benefit, motivation, interactivity, cost, time, and reusability. Participants rated the benefits of learning objects on a scale 1 to 5, where 1 was strongly disagree and 5 was strongly agree.

In response to the overall benefits of learning objects in supporting instructional design processes, generally, participants (80.6%, n = 146) were positive about the overall benefits, with

only a small number (2.8%, *n* = 5) having reservations. More than half of the participants (51.9%, *n*=94) strongly agreed with the overall benefits. Equally, many of the participants (77.6%, *n* = 135) demonstrated positive reactions to the flexibility of learning objects to be reused in different contexts. Along with overall benefits and reusability, generally, IDT practitioners were satisfied with the quality of learning objects to support interactivity features (*M*=4.09, *SD*=0.95). Specifically, about 71 percent agreed with the effectiveness of learning objects to incorporate interactive features into instruction (*n* = 128).

Overall, participants showed the agreement with the remaining benefits, which include motivation (M=3.79, SD=1.12), cost (M=3.71, SD=1.28), and time (M=3.65, SD=1.33). About half of the participants agreed that learning objects were effective in motivating learners (55.1%, n =101), as well as in decreasing development costs (53.3%, n =96) and time (53.1%, n =95). Compared with other benefit items, larger portion of participants were negative regarding cost (16.7%, *n* = 30) and time reduction effects (20.1%, *n* = 36) from the use of learning objects. On the previous items, less than 5 % of participants demonstrated negative reactions (overall benefit: 2.8%, *n* =5; interactivity: 3.4%, *n* =6; reusability: 4%, *n* =7, respectively).

Table 17. Perceived Benefits of Learning Objects

Benefits	1. Strongly Disagree	2	3	4	5. Strongly Agree	N/A	Mean (SD)
Overall benefits	0.6% (1)	2.2% (4)	12.2% (22)	28.7% (52)	**51.9% (94)**	4.4% (8)	4.43 (0.88)
Motivation	2.7% (5)	8.2% (15)	29.5% (54)	**31.1% (57)**	24.0% (44)	4.4% (8)	3.79 (1.12)
Interactivity	1.7% (3)	1.7% (3)	21.0% (38)	**42.5% (77)**	28.2% (51)	5.0% (9)	4.09 (0.95)
Cost	6.7% (12)	10.0% (18)	**26.1% (47)**	23.9% (43)	**29.4% (53)**	3.9% (7)	3.71 (1.28)
Time	7.8% (14)	12.3% (22)	23.5% (42)	22.9% (41)	**30.2% (54)**	3.4% (6)	3.65 (1.33)
Reusability	0.6% (1)	3.4% (6)	15.5% (27)	30.5% (53)	**47.1% (82)**	2.9% (5)	4.29 (0.92)
Total (183)							

Overall results showed that participants across various organizations were satisfied with learning objects' overall benefits, reusability and interactivity features. Specifically, participants

across all sectors agreed with the overall benefits. In terms of reusability, participants in all organizations except the military indicated satisfaction. Aside from participants in the military and non-profit organizations, participants in other sectors agreed with the interactivity benefits.

Overall, participants were less convinced of learning objects' time and cost effectiveness. However, participants in non-profit organizations (M=4.22), community colleges (M=4.15) and industry/business (M=4.13) showed their agreement with cost effectiveness. Respondents in non-profit organizations (M=4.25) and industry (M=4.05) showed satisfaction with time effectiveness.

Compared with other sectors, participants in industry/business were satisfied with the benefits of learning objects. On the contrary, participants in military/government were less convinced of the benefits of learning objects because overall benefit is the only item whose mean is greater than 4.

Table 18. Perceived Benefits of Learning Objects across Different Organizations

	Mean (SD)					
	Higher ed	Com.collg	Industry	Military	K-12	Non-Profit
Overall benefits	**4.42 (0.90)**	**4.50 (0.76)**	**4.49 (0.91)**	**4.14 (0.77)**	**4.60 (0.70)**	**4.11 (1.17)**
Motivation	3.83 (1.07)	3.93 (0.62)	3.67 (1.28)	3.29 (0.99)	**4.50 (0.71)**	3.22 (1.56)
Interactivity	**4.09 (0.99)**	**4.00 (0.58)**	**4.15 (1.04)**	3.79 (0.70)	**4.50 (0.53)**	3.67 (1.22)
Cost	3.43 (1.40)	**4.15 (1.07)**	**4.13 (1.08)**	3.64 (0.63)	3.20 (1.40)	**4.22 (0.97)**
Time	3.42 (1.42)	3.50 (1.73)	**4.05 (1.12)**	3.57 (0.76)	3.50 (1.35)	**4.25 (0.71)**
Reusability	**4.27 (0.93)**	**4.23 (0.93)**	**4.35 (0.92)**	3.86 (1.10)	**4.44 (0.88)**	**4.56 (0.73)**

In addition to the preceding six benefits, participants were asked to describe other benefits that they perceived when using learning objects. Forty seven participants provided responses. Participants' comments were analyzed and grouped into similar categories. The synthesis of common aspects of these benefits revealed three categories. The three categories that emerged were benefits to IDT personnel, learners, and the organization. By pondering over the

interrelation of these three categories and/or identified benefits, one theme has emerged. That is, in conclusion, benefits of learning objects need to be investigated from viewpoints of these three agents: IDT practitioners, learners and organizations. As IDT practitioners, learners and organizations are major agents to influence and/or be influenced by the implementation of learning objects, the considering of three perspectives will provide the complete picture of benefits of learning objects.

Comments from forty seven participants showed specific examples of benefits from three perspectives. First, from the perspective of IDT personnel, as creators of learning objects, benefits were indicated. That is, participants explained that learning objects were effective in improving the quality of the instruction by providing multiple perspectives and alternative ways to develop a learning experience. Also, learning objects helped participants to modify and create courses easily through the use of existing instructional content. As a result, participants could save development time and costs.

Also, as learners are major recipients of learning objects created by IDT practitioners, participants addressed learners' benefits. From the learners' perspective, learning objects improved the interaction and communication among learners. By offering various choices to learners, learning objects facilitate self-directed and experiential learning for learners.

Finally, participants examined the benefits of learning objects from their own organization's perspective. For example, organizations could gain benefits such as community building and quality control of offered courses.

Table 19. Other Benefits of Learning Objects

Other benefits (47)	
IDT personnel	Provided multiple perspectives and alternate ways
	Helped modify and create courses
	Saved development costs and time
Learners	Improved the interaction and communication with learners
	Aided self-directed and experiential learning
Organization	Community building and quality control of courses

Adoption Status

The fourth research question scrutinized the adoption status of learning objects. Survey questions, from Part II, numbers 1 through 5, examined the fourth research question. This part presented the summary results of participant responses to the adoption status and intended use of learning objects in their own organizations. Also, this section reported participants' actual and project-based use of learning objects, along with their adoption factors.

Survey Question One asked participants to report the adoption status of their organizations by choosing one of four options. Regarding the adoption status of learning objects, many of the organizations (86.2%, n = 163) had adopted learning objects or were planning to adopt. Particularly, a large portion of respondents' organizations were currently using learning objects (62.4%, n = 118) or were seeking additional information and/or exploring implementation of learning objects (23.8%, n = 45). A comparatively smaller portion of organizations (13.7%, n =26) was not using or not familiar with learning objects. About 10% of participants' organizations (n=18) were not currently using learning objects, while 4.2% of participants were not familiar with learning objects (n=8).

Question Two requested participants to reveal the future adoption status of learning objects in their organizations. Overall, out of 186 respondents of this question, about 70 % of respondents described their organizations as intending to increase the use of learning objects in

the future for work/learning (*n* =126) or to use learning objects (*n* = 121). Particularly, the largest proportion of participants strongly agreed with their organizations' increased use (41.4%) and intentions of use (40.1%). In summary, IDT practitioners were positive that their organizations would use (*M* =4.20, *SD* =1.34) and increase the use of learning objects (*M* =4.20, *SD* =1.29) in the future.

Table 20. Adoption Status and Intentions to Use

Adoption Status								Percent (Frequency)
Currently using LO								62.4% (118)
Seeking additional information/ exploring implementation								23.8% (45)
Not using LO								9.5% (18)
Not familiar with LO								4.2% (8)
Intentions to Use	1. Strongly Disagree	2	3	4	5. Strongly Agree	Don't Know	Total	Mean (SD)
Intentions of increased use	6.5% (12)	5.4% (10)	10.8% (20)	26.3% (49)	41.4% (77)	9.7% (18)	186	4.20 (1.29)
Intentions to use	7.9% (14)	5.1% (9)	7.9% (14)	28.2% (50)	40.1% (71)	10.7% (19)	177	4.20 (1.34)

Regarding the current adoption status, the overall results showed that the highest proportion of respondents revealed the current utilization of learning objects at the organizational level. Similarly, participants from different sectors showed the same results.

In terms of the future adoption status, the overall result suggested a promising future with the means larger than 4. The results from each of the organizations revealed similar patterns. Respondents in all sectors except non-profit organizations agreed with their organization's intentions to increase the use of learning objects. Respondents in sectors other than industry/business and non-profit organizations showed positive responses to their organizations' intentions to use learning objects.

Table 21. Adoption Status and Intentions to Use across Different Organizations

	Percent (Frequency)					
Adoption Status	Higher ed	Com. collg	Industry	Military	K-12	Non-Profit
Currently using LO	**61.1% (58)**	**64.3% (9)**	**58.5% (24)**	**66.7% (10)**	**100% (10)**	**44.4% (4)**
Exploring implementation	24.2% (23)	28.6% (4)	29.3% (12)	20.0% (3)	0% (0)	22.2% (2)
Not using LO	7.4% (7)	7.1% (1)	12.2% (5)	6.7% (1)	0% (0)	33.3% (3)
Not familiar with LO	7.4% (7)	0% (0)	0% (0)	6.7% (1)	0% (0)	0% (0)

	Mean (SD)					
Intentions to	Higher ed	Com. Collg	Industry	Military	K-12	Non-Profit
Increase the use	**4.22 (1.29)**	**4.64 (0.93)**	**4.05 (1.49)**	**4.47 (1.13)**	**4.60 (0.52)**	3.33 (1.41)
Use	**4.26 (1.34)**	**4.64 (0.93)**	3.86 (1.57)	**4.57 (1.09)**	**4.50 (0.53)**	3.67 (1.58)

Question Three asked participants to indicate their current usage of learning objects. One hundred and eighty eight responded to the question on the actual use of learning objects. The data showed that at the individual level, 82.4 % of participants (*n* =155) were currently using learning objects in their professional role. Specifically, while 28.2 % (*n* =53) of respondents used learning objects less than once each week, about 54.3 % of respondents (*n* =102) used learning objects at least once each week. Among frequent users of learning objects, weekly users comprised 33% (*n* =62) of total respondents, with daily users accounting for 21.3% (*n* =40).

In response to Question Four, 187 respondents reported their current level of usage of learning objects across projects. Many respondents (87.2%, *n* =163) were currently using learning objects for their projects. A large proportion of respondents reported the use of learning objects for less than 50% of their projects (55.1%, *n* =103), while having about one third (32.1%, *n* =60) of participants using for more than 50% of their projects. Users for less than 25% projects fell under the largest category out of 5 categories (39.6%, *n* =74).

Table 22. Actual and Project Based Use

Actual Use	Percent (Frequency)	Project Based Use	Percent (Frequency)
Don' use at all	17.6% (33)	Less than 25% of my projects	39.6% (74)
Use less than once each week	28.2% (53)	25%-49% of my projects	15.5% (29)
Use about once each week	13.3% (25)	50%-74% of my projects	15.5% (29)
Use several times each week	19.7% (37)	75%-99% of my projects	8.6% (16)
Use about once each day	5.3% (10)	100% of my projects	8.0% (15)
Use several times each day	16.0% (30)	Do not currently use LO	12.8% (24)
Total	(188)	Total	(187)

The overall results showed that the largest portion of participants used learning objects less than once each week. The same result was found among participants in higher education, community college, and military/government. A different frequency was detected among participants in other sectors. The largest proportion of respondents in industry/business utilized learning objects several times each week while the largest portion of respondents in K-12 used learning objects several times each day. However, the largest proportion of participants in non-profit organizations did not use learning objects at all for their jobs.

In terms of project-based use, the largest portion of respondents utilized learning objects for less than 25% of their projects. Similar results were detected among participants from higher education, community college, industry/business, military/government and non-profit organizations. However, the largest number of participants in K-12 utilized learning objects for 50%-74% of their projects.

Table 23. Actual and Project Based Use across Different Organizations

Actual use	Percent (Frequency)					
	Higher ed	Com. collg	Industry	Military	K-12	Non-Profit
Don't' use at all	16% (15)	7.1% (1)	19.5% (8)	33.3% (5)	0% (0)	**44.4% (4)**
Less than once a week	**31.9% (30)**	**50% (7)**	17.1% (7)	**33.3% (5)**	10% (1)	11.1% (1)
Once each week	16% (15)	7.1% (1)	14.6% (6)	13.3% (2)	0% (0)	0% (0)
Several times each week	17% (16)	21.4% (3)	**29.3% (12)**	13.3% (2)	20% (2)	11.1% (1)
Once each day	7.4% (7)	7.1% (1)	0% (0)	0% (0)	10% (1)	11.1% (1)
Several times each day	11.7% (11)	7.1% (1)	19.5% (8)	6.7% (1)	**60% (6)**	22.2% (2)
Project-based use	Percent (Frequency)					
	Higher ed	Com. collg	Industry	Military	K-12	Non-Profit
Less than 25%	**42.4% (39)**	**60% (9)**	**24.4% (10)**	**60.0% (9)**	10% (1)	**33.3% (3)**
25%-49%	17.4% (16)	13.3% (2)	14.6% (6)	6.7% (1)	20% (2)	11.1% (1)
50%-74%	10.9% (10)	20% (3)	**24.4% (10)**	6.7% (1)	**30% (3)**	11.1% (1)
75%-99%	8.7% (8)	0% (0)	9.8% (4)	6.7% (1)	20% (2)	11.1% (1)
100%	7.6% (7)	0% (0)	12.2% (5)	0% (0)	20% (2)	11.1% (1)
Do not currently use LO	13% (12)	6.7% (1)	14.6% (6)	20.0% (3)	0% (0)	22.2% (2)

Question Five asked participants to provide the reasons for their current use of learning objects in terms of perceived usefulness and ease of use. Participants were asked to choose all the applicable factors and provide other reasons for their current usage of learning objects, if none of the example factors were applicable. In response to the first sub-question on perceived usefulness items, 147 responded. The largest proportion of participants agreed that learning objects enhanced their instructional effectiveness (67.3%, *n* =99). Next to this, similar proportion of participants thought that learning objects were useful (61.9%, *n* =91) in their designing/developing and teaching and learning objects made it easier to design, develop, and teach course content (61.2%, *n* =90). Compared with the perceived usefulness and effectiveness, fewer participants thought that learning objects increased their designing/developing/teaching productivity (46.9%, *n* =69) or helped them to accomplish designing/developing/teaching tasks more quickly (49.0%, *n* =72).

The second sub-question asked respondents to choose all the applicable factors that influenced their current use of learning objects, in relation to perceived ease of use. Out of six factors, the highest proportion of participants (57.2%, *n* =79) indicated that they used learning objects because learning to use learning objects was easy for them. Next to this, 47.1% of participants found that learning objects were flexible to use (*n* =65). The same proportion of participants reported that learning objects were easy to use and that their own interaction with learning objects was clear (42%, n=58). About one third of participants reported that it is easy for them to become skillful at using learning objects (33.3%, *n* =46) or found it easy to do what they want learning objects to do (31.2%, *n* =43).

Finally, participants were asked to provide other reasons for their current usage of learning objects, if none of above example factors were applicable. For other adoption factors, participants mentioned economic reasons (*n* =6) and the flexibility of learning objects to be reused across multiple courses (*n* =4). Other participants reasoned that learning objects supported learning effectively (*n* =3), and they had to meet institutional requirements to use learning objects (*n* =3). Out of 21 responses, five responses were invalid as these responses did not address the question. Two participants were complaining about the difficulties of use and three were exploring the use.

Table 24. Adoption Factors

Perceived Usefulness	Percent (Frequency)	Perceived Ease of Use	Percent (Frequency)
Easier to design/develop/teach	61.2% (90)	Learning was easy	**57.2% (79)**
Enhances my effectiveness	**67.3% (99)**	Easy to do what I want LO to do	31.2% (43)
Increases my productivity	46.9% (69)	Interaction with LO is clear	42.0% (58)
Accomplish tasks more quickly	49.0% (72)	Flexible to interact with	47.1% (65)
Useful in my work	61.9% (91)	Easy for me to become skillful	33.3% (46)
		Learning objects easy to use	42.0% (58)
Total	(147)	Total	(138)
Other reasons (21)	Frequency	Other reasons	Frequency
Economic reason	6	Flexibility to be reused	4
Support for learning	3	Institutional requirements	3
Invalid	5		

According to the overall results, out of perceived usefulness factors, a large proportion of participants agreed that learning objects enhanced their instructional effectiveness, were useful in their designing/developing and made it easier to design, develop and teach course content. Similar results were noted across other organizations, other than non-profit organizations. While a large proportion of respondents in non-profit organizations agreed that learning objects were useful and made their job easier, a large proportion of respondents also agreed that learning objects helped them accomplish tasks quickly.

Out of factors related to perceived ease of use, the overall results revealed that the largest proportion of participants agreed that learning to use learning objects was easy. The same result was detected among participants in higher education, community college, K-12 and non-profit organizations. However, industry/business and military/government showed different results. The largest proportion of industry/business respondents agreed that learning objects were flexible to interact with. Among military/government participants, the prominent factor was that it was easy to do what they want learning objects to do.

Table 25. Adoption Factors across Different Organizations

Perceived usefulness	Percent (Frequency)					
	Higher ed	Com. collg	Industry	Military	K-12	Non-Profit
Easier to design/develop	**21% (42)**	**17.9% (7)**	**22.5% (23)**	**11.1% (2)**	**21.9% (7)**	**29.4% (5)**
Enhances effectiveness	**25% (50)**	**23.1% (9)**	**20.6% (21)**	**44.4% (8)**	**21.9% (7)**	11.8% (2)
Increases productivity	17% (34)	**17.9% (7)**	17.6% (18)	5.6% (1)	15.6% (5)	11.8% (2)
Accomplish tasks quickly	15.5% (31)	15.4% (6)	18.6% (19)	**11.1% (2)**	15.6% (5)	**29.4% (5)**
Useful in my work	**21.5%(43)**	**25.6% (10)**	**20.6% (21)**	**27.8% (5)**	**25% (8)**	**17.6% (3)**
Perceived ease of use	Percent (Frequency)					
	Higher ed	Com. collg	Industry	Military	K-12	Non-Profit
Learning was easy	**23.2% (39)**	**33.3% (9)**	19.3% (16)	15.4% (2)	**21.7% (5)**	**26.4% (5)**
Easy to do what I want	9.5% (16)	3.7% (1)	18.1% (15)	**30.8% (4)**	8.7% (2)	10.5% (2)
Clear interaction	16.7% (28)	14.8% (4)	15.7% (13)	23.1% (3)	13% (3)	21.1% (4)
Flexible to interact with	19.6% (33)	14.8% (4)	**20.5% (17)**	7.7% (1)	**21.7% (5)**	15.8% (3)
Easy to become skillful	13.7% (23)	11.1% (3)	13.3% (11)	7.7% (1)	17.4% (4)	10.5% (2)
Easy to use	17.3% (29)	22.2% (6)	13.3% (11)	15.4% (2)	17.4% (4)	15.8% (3)

Summary

Chapter Four shared survey findings from 191 IDT practitioners who represented higher education, industry/business, military/government, K-12 and non-profit. These participants were engaged in IDT practice for more than 10 years and had about seven years of experience with learning objects. The study results showed these IDT practitioners' perceptions and use of learning objects in terms of the conceptualization, current utilization, perceived benefits and adoption status of learning objects.

The study findings showed both the current focus of and the components of the definition of learning objects among IDT practitioners. The participants thought that the focus of the current conceptualization of learning objects should be on a combination of technical and learning aspects. In addition, participants perceived the three most important features to be included when defining learning objects, which are reusability, instructional support, and digital resources.

With regard to the current utilization of learning objects, the study showed that a large proportion of participants were currently utilizing learning objects to empower learners to have more control over their own learning. The study further explored the current utilization status in relation to design strategies and granularity levels. Participants were found to be frequently adopting example design strategies, such as learning strategy supports, the creation of learning objectives for individual learning objects, and the provision of concrete, authentic examples and problems. While most participants employed five granularity levels, combined media was the most frequently utilized level, followed by asset and then one instructional unit. In giving reasons for the most frequently utilized granularity level, participants explained that the combined media level was easy to reuse in different contexts or that they chose it because of the nature of the learning topic. Participants sometimes varied the granularity levels across projects.

The study results revealed perceived benefits of learning objects in terms of overall support, motivation, interactivity, cost, time and reusability. Participants expressed positive views on learning objects' overall support for the IDT process and their flexibility to be reused. Likewise, learning objects' support for interactive features and motivation were regarded as benefits of their adoption. However, participants revealed some concerns about decreasing development time and cost.

With regard to current adoption status, more than 80% of organizations were currently adopting or planning to adopt learning objects. Participants were positive that their organizations would use and increase the use of learning objects in the future. In terms of actual use at an individual level, more than half of the participants used learning objects at least once a week, but for less than 50% of their projects.

The present study explored adoption factors in terms of both the perceived usefulness and the ease of use of learning objects. Participants agreed that learning objects enhanced their instructional effectiveness, were useful in their IDT practice, and made it easier to design, develop and teach course content. Compared with perceived usefulness, participants were less convinced of learning objects' perceived ease of use. While more than half of the participants agreed that learning to use learning objects was easy for them, only a small proportion of participants agreed that it was easy to do what they wanted to do with learning objects or to become skillful in using learning objects.

Chapter Five: Discussion

The primary purpose of this study was to explore the perceptions and the actual use of learning objects among IDT practitioners across various organizations. Specifically, this study aimed to address the following research questions and their ancillary sub-questions:

(1) What is the current conceptualization of learning objects?

(2) How are learning objects currently being used across varying organizations? What sizes of learning objects are IDT practitioners using? What design strategies are IDT practitioners adopting when using learning objects?

(3) What are the perceived benefits of learning objects in terms of their support for instructional design and development?

(4) What is the adoption status of learning objects across varying settings? How do adoption factors affect the current use of learning objects?

To investigate these research questions, this study constructed a survey instrument, based on the literature related to learning objects in four areas. Using the survey, this study collected data from 191 IDT practitioners across various organizations. The survey data was analyzed by using a descriptive approach that incorporated both quantitative and qualitative research methodologies.

The study results contribute to the body of knowledge on learning objects in terms of four areas: their conceptualization, utilization, benefits, and adoption. First, the study results should allay the concern that the conceptualization of learning objects has too much of a focus on technical aspects. IDT practitioners emphasized both technical and learning aspects in conceptualizing learning objects. Second, the study showed that IDT practitioners utilize design strategies to reinforce concepts and provide practice and application. Combined media, which

consists of content and optional media, was the most frequently utilized granularity level of the five options. Third, IDT practitioners were positive about the overall benefits for the ID process and reusability of learning objects. However, they were less convinced of the time and cost saving aspects that may not relate directly to their job roles. And, finally, many of the participants' organizations had adopted or were exploring the implementation of learning objects with intentions to use in the future.

In conclusion, the study laid the foundation for a working definition of learning objects based on their current conceptualization among IDT practitioners. The study provided empirical data to help determine formal design strategies. The study increased the understanding of granularity levels of learning objects. The study filled the research gap on benefits of learning objects from an IDT perspective, along with the current/future adoption status guided by theories.

Background Information

Participants of the study can be described as IDT professionals working in higher education organizations (51%) of more than 500 employees (57%). They have more than 10 years of practice (67%) as IDT practitioners and are experienced users of learning objects, with about seven years as their average learning object experience. The large organizational size of participants confirmed previous findings on the positive relation between the size of the organization and the adoption of new technology (Ko, Kim, & Woo, 2008). Also, the finding on participants' seven-year average experience with learning objects was consistent with the study on the positive relationship between previous experiences with a technology and the adoption of the technology (Lia & Lu, 2007).

Definition of Learning Objects

Educators have been concerned that there is too much focus on technical aspects in defining learning objects (Northrup, Rasmussen, & Dawson, 2004; Parrish, 2004). In response, the study attempted to explore how learning objects are currently conceptualized among users of learning objects in the IDT field. The study results revealed that most respondents thought that the definition of learning objects should focus on a combination of technical and learning aspects. Therefore, in terms of the focus on the definition, current conceptualizations among users of learning objects were aligned with the efforts of researchers to define learning objects through the integration of learning and technical concepts (Koper, 2003; Mavrommatis, 2008; Sosteric & Hesemeier, 2002; Wiley, 2002).

In addition to the focus on a combination of learning and technical aspects, more respondents (30%) emphasized learning aspects of learning objects, compared with only 3% of respondents who chose technical aspects as the focus. This emphasis is consistent with researchers' focus on learning aspects (Wiley, 2002). For example, Churchill (2007) elaborated the definition of learning objects by referring to underlying learning principles and integration of learning theories without directly mentioning technical aspects. Furthermore, Parrish (2004) defined learning objects in terms of learning process or strategy, with the focus on the meaning-making process as the essence of learning objects.

By analyzing current literature, the present study identified three characteristics in the definition of learning objects: digital resources (Laverde, et al., 2007; Cochrane, 2005; IEEE, 2002; Koper, 2003; Mavrommatis, 2008; Northrup, et al., 2004; Sosteric & Hesemeier, 2002; Wiley, 2002), reusability (Laverde, et al., 2007; Cisco, 2003; IEEE, 2002; Mavrommatis, 2008; Northrup, et al., 2004; Wiley, 2002), and instructional support (Laverde, et al., 2007; Cisco,

2003; IEEE, 2002; Koper, 2003; Mavrommatis, 2008; Sosteric & Hesemeier, 2002; Wiley, 2002). By constructing these three components as survey items in describing learning objects, the study further explored the current conceptualization of learning objects among IDT practitioners. The study results showed that, generally, users of learning objects agreed with the importance of these features, with emphasis on reusability and instructional support. The perceived importance of these aspects confirmed that current conceptualizations of learning objects represented both technical (reusability) and learning aspects (instructional support). Therefore, the present study provided empirical data that counters the idea that the current conceptualization of learning objects focuses too much on technical aspects (Yahya & Yusoff, 2008).

The study further explored what other components IDT practitioners considered important to the definition of learning objects, in addition to these three components. The study showed that many of these additional components were related to technical aspects. The most frequently mentioned components included metadata tagging, self-containment, granularity, re-purposeabilty, and interoperability.

In addition to these technical components, participants provided other instructional components. Participants emphasized learning objects' educational purpose, which aligned with the preceding findings on the focus of the definition of learning objects. Also, participants described some instructional components such as learning objectives, content and assessment, in conceptualizing learning objects. These features reflect the efforts of prior research that explored the concept of learning objects by specifying the same components as essential characteristics (Jonassen & Churchill, 2004; Lim, Lee, & Richards, 2006; Nugent, Soh, & Samal, 2006).

Beyond the technical and learning features, some respondents included ownership as a component of the description of learning objects in order to protect intellectual property. There has been a lack of research to define learning objects in this regard. The inclusion of ownership in the conceptualization of learning objects was a new finding of this study, and which contributes to the body of knowledge on the components of the definition of learning objects. As suggested by participants, the inclusion of this component might further stimulate the free sharing of learning objects, which is currently discouraged because of copyright issues (Parrish, 2004).

In summary, the study explored the current conceptualization of learning objects among users of learning objects in the IDT field. The study found that these users emphasized a combination of learning and technical aspects in defining learning objects. While participants agreed with the instructional focus of learning objects, they also considered some technical features essential in defining learning objects. Therefore, the current conceptualization supports a definition that integrates both learning and technical characteristics of learning objects.

Current Utilization

Through the literature review, the study identified three themes in utilizing learning objects. By capitalizing on advanced technical features of learning objects, attempts have been made to automate the instructional design process (ADL, 2001; IEEE, 2002; Merrill, 2002; Spector & Ohrazda, 2003). In response to the criticism of these attempts for isolating learners from other human beings, learning objects have been used to aid instructional designers, developers, and instructors (Muzio, Heins, & Mundell, 2002; Recker, Dorward, & Nelson, 2004). Beyond the influence on the instructional design process through the automation and the aid for instructional designers and developers, learning objects have been utilized to empower

learners to construct their own learning (Bannan-Ritland, Dabbagh, & Murphy, 2002; Collis & Strijker, 2001; Duval, Hodgins, Rehak & Robson, 2004; McGee, 2006; Tan, Aris, & Abu, 2006). These three themes were constructed as three survey items to explore how IDT practitioners are currently utilizing learning objects.

The study results showed that the majority of IDT professionals were utilizing learning objects to empower learners to have more control over their own learning. Compared with the use of learning objects for automation and aid for instructional designers and developers, the utilization of learning objects to empower learners was a recent trend. There have been empirical studies in the utilization of learning objects for the automation and aid for instructional designers and developers (Merrill, 2002; Muzio, Heins, & Mundell, 2002; Recker, Dorward, & Nelson, 2004). However, there has been a lack of empirical studies that use learning objects to have learners more control while researchers have provided theoretical support for the use of learning objects to empower learners (Bannan-Ritland, Dabbagh, & Murphy, 2002; Collis & Strijker, 2001; Duval, Hodgins, Rehak & Robson, 2004; McGee, 2006; Tan, Aris, & Abu, 2006). The present study provided the support for the importance of the role of learners to control learning objects (Schatz, 2005). The study also revealed the need for additional experimental studies that explore the use of learning objects by learners to integrate practical application with the theoretical framework, in order to provide further empirical evidence to examine this trend.

IDT professionals also utilize learning objects to aid the instructional design process. The study results were corroborated by previous studies on the use of learning objects by instructional designers, developers, and instructors (Muzio, Heins, & Mundell, 2002; Recker, Dorward, & Nelson, 2004).

At the early stages of the utilization of learning objects, many attempts were made to automate the instructional design process (ADL, 2001; IEEE, 2002; Merrill, 2002). However, educators showed their concerns over these dehumanizing effects caused by replacing instructional designers and instructors with intelligent systems (Spector & Ohrazda, 2003; Wiley, 2003). Reflecting the shift of the focus of learning objects away from automation, comparably fewer IDT practitioners were found to utilize learning objects for the automation of the ID process.

Design Strategies

Despite efforts to explore effective design strategies to utilize learning objects for teaching and learning practice, there has been no consensus on formal instructional design strategies. In response, with the aim to provide a basis for the development of formal instructional strategies based on current practices of IDT professionals, the study explored how IDT professionals utilized instructional strategies in designing and developing learning object-based instruction. By analyzing and synthesizing design strategies utilized in prior research, the study identified seven design strategies and explored how these strategies were utilized by IDT professionals.

The study results indicate that most IDT professionals across various settings are currently utilizing the design strategies delineated in the literature (Kay & Knaack, 2007a; Krauss & Ally, 2005; Lim, Lee, & Richards, 2006; Nugent et al., 2006). Most responses indicate strategies used to reinforce concepts and provide practice and applications. The most frequently used design strategy was providing concrete, authentic examples and problems. The design strategies of this study might be considered as the basis for the development of formal design

strategies for learning objects. Future studies are needed to empirically investigate the effect of these design strategies on learners.

Granularity Levels

Despite the perceived importance of learning objects' granularity levels, there has been confusion regarding granularity levels among educators. In an attempt to contribute to research efforts to define the granularity levels of learning objects, the present study explored what granularity levels were used among IDT practitioners across various organizations. By integrating prevalently used granularity levels (ADL, 2004; Bannan-Ritland, Dabbagh, & Murphy, 2002; Cisco, 2003), the study presented five granularity levels for consideration: assets, combined media, one complete instructional unit, module, and course.

The study results showed that most IDT professionals utilize all five of granularity levels and vary the granularity of learning objects across different projects. No other parameters of learning objects were described by participating users of learning objects.

As Wiley (2002) mentioned, in spite of efforts to define the optimal granularity level, there has been no consensus. To provide the preliminary data for the studies on optimal granularity level, the study explored which granularity level was most frequently used by IDT professionals. In searching for the optimal granularity level, researchers have focused on the third level which is equivalent to a "unit" of instruction (Jonassen & Churchill, 2004; Kay, 2007; Lim, Lee, & Richards, 2006; Nugent, Soh, & Samal, 2006). A unit consists of several media and might include learning objectives, content, practice, assessment, and additional media.

The study results contradict previous research indicating the unit as the optimal granularity level. The most frequently used level was combined media which consists of content

and a combination of optional media, while the unit was the second most frequently used level. According to prior studies, the combined media level was considered too small to include the necessary context to make learning meaningful (Kay & Knaack, 2007b; Nugent, Soh, & Samal, 2006). While combined media has not received much attention when exploring the optimal granularity level from a learning perspective, the present study shows the need to consider combined media as a potential candidate for the optimal granularity level from the IDT professional's perspective.

The asset was also found to be one of the most frequently utilized levels. This result reveals the need for the meta-tagging of assets. As meta-tagging of every level of reusable objects is difficult and time-consuming, considering the huge number of metadata-tagging items, every level of reusable learning objects has not been meta-tagged (South & Monson, 2002). For example, in the SCORM model, one of the most widely accepted standards for learning objects, assets are not meta-tagged, but higher levels of learning objects are meta-tagged (ADL, 2004). When learning objects are meta-tagged, users can search for learning objects from the learning object repository (South & Monson, 2002). The frequent use of assets among IDT professionals indicates the need to consider the meta-tagging of assets for the convenience of users of learning objects.

To examine related factors and contexts that influence the use of granularity levels, based on the literature review, the present study identified four reasons for learning object utilization which include reusability, the affordance of the learning object system, the nature of the learning topic and the ease of customization. One of the most prevalent reasons for the frequent usage of the specific size of learning objects was related to reusability. That is when IDT professionals found learning objects easy to reuse in different contexts, they chose that level.

This result explained why smaller sized learning objects, such as combined media and assets, were frequently utilized by IDT professionals. While lower levels of learning objects were more easily reused in different contexts, higher levels of learning objects were more difficult to reuse (Wiley, Gibbons, & Recker, 2000).

Along with reusability, many users of learning objects chose the nature of the learning topic (complexity level). The results showed that while IDT professionals' choice of granularity level was driven by the ease of reuse, they were also considering learning effectiveness. IDT professionals face a challenge when utilizing learning objects to teach complex learning topics. To address complex learning outcomes, they need to utilize higher levels of learning objects, which contain appropriate content and context (McGee, 2006; Wiley, 2000). But, as higher levels of learning objects are difficult to reuse and customize, IDT professionals might need to create higher level learning objects from scratch or spend a lot of time locating appropriate lower level learning objects to combine. Also, once they create higher level learning objects, these learning objects cannot be easily reused by others.

Perceived Benefits

Previous efforts have been made to evaluate the benefits of learning objects from students' and teachers' perspectives. To get broader perspectives on the benefits of learning objects, the present study incorporated instructional designers and developers by inviting IDT practitioners across various organizations to participate in the survey.

The study results indicated that IDT professionals agreed upon overall benefits of learning objects. Learning objects were effective in supporting instructional design processes. The results confirmed previous findings, which showed that instructional designers and developers benefit from the use of learning objects (Hsin-Yih, Shang-Hsien, & Yu-Hur, 2004;

Kang, Lim & Kim, 2004; Wang & Hsu, 2006). While these previous studies presented the benefits of learning objects in supporting instructional design and development processes, they focused on the effectiveness of specific learning object systems. These studies were based on the users of some specific learning object system in a single organization. The current study results contribute to the knowledge base on how effectively learning objects support the instructional design and development process from a broader perspective beyond users of a specific learning object system in a single institute.

Along with overall benefits, IDT professionals demonstrated positive reactions to the reusability benefits of learning objects. While reusability has been emphasized as one of the key characteristics of learning objects because of its role in helping create instruction more efficiently, there has been a lack of research examining how effective learning objects were in supporting the reusability of learning contents in different contexts across various settings. Some studies measured reusability related to instructional content, while others have focused on reusability in terms of technical flexibility (Nesbit, Belfer, & Vargo, 2002). Other studies showed mixed results on perceived effectiveness of reusability based on specific groups of users such as instructional developers or teachers, thus limiting their findings (Cochrane, 2005; McCormick & Li, 2006). The findings of the present study filled the research gap on the perceived effectiveness of reusability by users of learning objects, by focusing on reusability separated from interoperability and by incorporating various users to make results applicable across various contexts. Also, the study provides empirical data to further explore reusability characteristics of the existing studies (Cochrane, 2005; McCormick & Li, 2006).

This study also examined how effectively learning objects might influence learners through the motivation and interactivity features of learning objects. The present study showed

that IDT professionals agreed that learning objects were effective in motivating learners, as well as providing opportunities for interaction with content. Educators have been concerned that learning objects do not contribute to meaningful learning (Churchill, 2008; Yahya & Yusoff, 2008). To offset these concerns, efforts have been made to embed various features into learning objects with the aim to promote learning effectiveness (Kay, 2007; Lukasiak et al, 2004). The efforts of these educators were not fruitless, as the results of the present study showed participants were satisfied with the features of learning objects to motivate and interact with learners. Moreover, some participants mentioned that learning objects were effective in supporting self-directed and experiential learning. By being grounded on positive results of perceived benefits in supporting motivation and interactivity features for learning effectiveness, a future study is needed that would explore the effectiveness in supporting other features of pedagogically sound learning objects. Also, the results of the present study enriches the body of knowledge on the perceived benefits of learning objects in this regard, by adding the perspective of instructional designers and developers beyond teachers' and learners' perspectives of existing studies (Kay, 2007; Kay & Knaack, 2007b; McCormick & Li, 2006; Recker, et al., 2006).

Different from the ratings of perceived benefits of other items, IDT professionals showed mixed reactions to the effectiveness of learning objects in saving development cost and time. The results echoed the previous studies' mixed results. While some studies showed the effectiveness of learning objects in decreasing cost and time to create a new course, other studies demonstrated different results (Christiansen & Anderson, 2004; Dodds, 2002; Wang & Hsu, 2006). The mixed results might be caused by measuring time and cost effects without considering two different cases of the use of learning objects. Some IDT professionals mentioned that it took more time to create a course using learning objects as they first needed to assign metadata tags to the content.

They also indicated that it takes less time to create courses by reusing existing learning objects, however. To measure the effectiveness in terms of time and cost, future studies might need to separate two different processes of course development into the creation and reuse of learning objects.

Most of the additional benefits that participants mentioned fit into the existing categories of benefits, which are benefits from the perspectives of IDT personnel and learners. Beyond the benefits of IDT personnel and learners, some participants addressed organizational effectiveness. Current literature shows that there is a lack of research to explore the effectiveness of learning objects from organizational perspective. Most studies have focused on a micro-perspective of measuring effectiveness of learning objects by examining teachers, students, and instructional designers and developers. A future study is needed to explore a meso-perspective of the effectiveness of learning objects with the focused attention on organizational benefits of the use of learning objects. The examining of a meso-perspective of effectiveness of learning objects might stimulate the attempts to examine a macro-perspective of measuring the effectiveness of an open economy where learning objects are freely exchanged and shared, resulting in learning equity, as envisioned by researchers (Collis & Strijker, 2001).

Adoption Status

The present study also addresses a gap in the research base about the adoption status of learning objects across various organizations. According to Rogers (2003), there are five stages involved in Innovation Decision Model: knowledge, persuasion, decision, implementation, and confirmation. Based on Rogers' stages (2003), the present researcher constructed survey items. The implementation of learning objects was determined at the organizational level because of the infrastructure required for implementation; therefore, this study explored the adoption status at

that level. The study results showed that organizations of many IDT professionals are currently using learning objects. Following the implementation stage, many of these organizations belonged to the persuasion stage where these organizations were seeking more information and/or exploring the implementation of learning objects (Rogers, 2003).

Along with adoption status, the present study explored the future status of learning objects by examining behavior intentions. Behavior intentions were measured using two items: the intention to use and to increase use of learning objects. The study results indicated that the adoption of learning objects has a promising future, as participants were positive that their organizations were intending to use learning objects or to increase their use of learning objects in the future for work and/or learning. These behavior intentions should predict the adoption of learning objects, as previous studies showed that intention to use technology was closely related to actual adoption (Lau & Woods, 2008; Liao & Lu, 2007). As this study is based on users of learning objects, its results regarding adoption status need to be interpreted as the adoption status among users of learning objects. To determine the current and future adoption status of learning objects among IDT practitioners, future research studies should include those who are not users of learning objects.

Along with the organizational level, the present study examined the current usage status of learning objects at the individual level. The current usage status was explored in terms of actual and project-based use. Most of the participants were currently utilizing learning objects for their own projects or for their professional role. Some participants were found utilizing learning objects even though their organizations were not currently using them. These participants either belonged to organizations that were exploring the use of learning objects or were pioneers who led the adoption of new technology. This result indicates that future research studies should

explore the adoption status of learning objects at the individual level, in addition to the organizational level.

As adoption factors of learning objects, the present study explored two user beliefs that were known for their influence on user adoption and usage of the technology: perceived usefulness and ease of use (Davis, 1989; Davis, Bagozzi, & Warshaw, 1989). The results were aligned with those of previous studies, as many of the participants chose these items as the reason for their use of learning objects. In particular, participants preferred items they perceived as useful to supporting the IDT process. Compared with perceived usefulness, fewer participants cited perceived ease of use as their reason for adopting learning objects. This was consistent with previous studies, which showed usefulness to be the most significant factor influencing users' adoption of learning objects (Lau & Woods, 2008).

Previous studies showed that discrete items involving perceived usefulness and ease of use were closely related and developed to measure the same construct (Davis, 1989; Davis, Bagozzi, & Warshaw, 1989; Lau & Woods, 2008). However, participants had different reactions to these discrete items of the survey. For example, in the case of perceived usefulness, while many participants chose usefulness factors related to effectiveness in aiding the instructional design process, comparably fewer participants chose usefulness factors related to time and productivity. This result might be related to study results on the above perceived benefits, which demonstrated a positive perception of effectiveness in terms of the overall IDT process and mixed reactions to the time and cost-saving effects of learning objects. The different reactions were also true of items involving perceived ease of use. Considering the different reactions to the discrete items related to these factors, the present study suggests developing measures of adoption factors to more specifically address unique features of learning objects.

Study Limitations

While the current study was successful in getting participants from various organizations, these organizations were clustered around higher education, with a comparably smaller number of participants from other sectors. Future studies should obtain more participants from other sectors, especially K-12 education to explore actual use and perceptions of use from a broader perspective. The study's non-proportional distribution of participants' sectors might be caused by the fact that much of the work on learning objects has been conducted in higher education as indicated by the previous studies (Kay, 2007). From this perspective, future studies on K-12 education might need to adopt other methodologies, such as interviews and ethnographies, which utilize smaller sample sizes (Leedy & Ormrod, 2005).

The current study utilized a non-probability sample (or convenience sample) instead of a random sample, as participants were self-selected. Therefore, compared with random sampling, the results of the current study may have some limitations in terms of generalization (Creswell, 2003). The objective of this descriptive study was to provide a better understanding of the actual use and perceptions of learning objects with consideration of the utilization, conceptualization, benefits and adoption status of learning objects. The present study hopes to stimulate further research on issues related to the actual use and perceptions of learning objects.

The Impact of the Study on the IDT Field

This study enriched the knowledge base on teaching and learning using learning objects in the IDT field. This study explored the use of learning objects beyond a single setting, in which the existing studies on learning objects have been conducted (Bradley & Boyle, 2004; Cook, Holley, & Andrew, 2007; Nugent, Soh, & Samal, 2006; South & Monson, 2002; Wang & Hsu, 2006). By including higher education, industry/business, military/government, community

college, K-12 and non-profit sectors, the present study deepened the understanding of use of learning objects across various settings. By focusing on IDT practitioners across multiple settings as users of learning objects, the present study increased the knowledge of the use and perceptions of learning objects in the IDT field.

The concept of learning objects has been criticized for the lack of theoretical backgrounds (Parrish, 2004; Yahya & Yusoff, 2008). The study results showed that the current conceptualization in the IDT field focused on both learning and technical aspects. Educators can use the study results as one way to rebut the criticism of the current concept of learning objects. Based on the facets of important components identified in the present study, a potential working definition can be construed as "*learning objects are reusable digital resources that are meta-tagged, self-contained, and granular, and which serve the purpose of providing instructional support.*" Future study is needed to solicit consensus on this working definition.

The present study contributed to the understanding of the utilization of learning objects in the IDT field, with focused attention to design strategies and granularity levels. The present study found the prevalent use of learning objects to empower learners to have more control over their own learning. Compared with the use of learning objects for the automated ID process (Merrill, 2002; Spector & Ohrazda, 2003) and as an aid for instructional designers and developers (Muzio, Heins, & Mundell, 2002; Recker, Dorward, & Nelson, 2004), there has been a lack of empirical studies to explore the use of learning objects to empower learners. The present study shows the needs for future empirical study in the IDT field to investigate the utilization of learning objects for learners.

While there have been efforts to suggest design strategies for learning objects by individual studies (Bradley & Boyle, 2004; Cochrane, 2005; Farrell & Carr, 2007; Krauss &

Ally, 2005; Lim et al., 2006; Nugent et al., 2006), there has been a lack of studies to investigate what design strategies were currently utilized. In response, this study identified instructional design strategies utilized in the IDT field for learning objects: the provision of concrete, authentic examples and problems; the provision of learning strategy support; and the creation of learning objectives for individual learning objects. Based on the frequent use of these instructional strategies adopted by IDT practitioners of an average of seven years of experience with learning objects, educators can guide novice IDT practitioners to use these instructional strategies in designing learning object based instruction. Furthermore, educators may investigate the effects of these instructional strategies as an effort to seek formal instructional strategies for learning objects.

Aligned with efforts to establish the granularity levels for learning objects (Wiley, 2002), the present study increased the understanding of the granularity levels of learning objects in the IDT field. By synthesizing existing granularity levels (ADL, 2004; Bannan-Ritland, Dabbagh, & Murphy, 2002; Cisco, 2003), this study delineated the following five granularity levels: asset, combined media, unit, lesson or module, and course. Respondents indicated the use of all of these granularity levels, all of which are used across various types of organizations. Out of these five granularity levels, this study identified the combined media as the most frequently utilized level. This result is a new finding in the IDT field in terms of the potential optimal granularity level as the existing studies have paid attention to the unit as the optimal level (Jonassen & Churchill, 2004; Kay, 2007; Lim, Lee, & Richards, 2006; Nugent, Soh, & Samal, 2006).

This study provided knowledge on the perceived benefits of learning objects in the IDT field with regards to overall support, reusability, development time and cost, and the support for interactivity and motivation. As existing studies focused on benefits from the perspectives of

teacher and students, this study filled the research gap on benefits from the perspectives of IDT practitioners. Based on the findings on the overall benefits of learning objects in terms of overall support of ID processes, reusability, and the support for interactivity and motivation, educators are encouraged to use learning objects for their own instructional practices. Also, less positive reactions to the benefits in relation to the development time and cost show the need for the future studies to seek ways to improve the development time and cost in utilizing learning objects.

This study provided a comprehensive view on the adoption status of learning objects by exploring the current and future adoption status at individual and organizational levels. The present study contributed to the body of knowledge of reasons behind the adoption status of learning objects. However, as the current study has focused on the adoption and diffusion of learning objects, it shows the need for future study to explore the implementation and institutionalization stages suggested by Surry and Ely (2002). While studying the implementation and institutionalization status of learning objects, the future study might explore related factors to promote the implementation and institutionalization: dissatisfaction with the status quo; existence of knowledge and skills; availability of resources; availability of time; rewards or incentives; participation; commitment; and leadership (Ely, 1990).

REFERENCES

Association for the Advancement of Computing in Education (AACE). (2009). About AACE. Retrieved November 17, 2008, http://www.aace.org/about.htm

Advanced Distributed Learning (ADL). (2004). Sharable Content Objects Reference Model (SCORM). Retrieved August 25, 2007, from http://www.adlnet.gov/Technologies/scorm/default.aspx.

Association for Educational Communications and Technology (AECT). (2008). About AECT. Retrieved November 17, 2008, from http://www.aect.org/About/default.asp

Ahn, M., Beamish, J. O., & Goss, R. C. (2008). Understanding older adults' attitudes and adoption of residential technologies. *Family and Consumer Sciences Research Journal*, *36*(3), 243-260.

Andrews, D., Nonnecke, B., & Preece, J. (2003). Electronic survey methodology: A case study in reaching hard-to-involve Internet users. *International Journal of Human-Computer Interaction*, *16*(2), 185 - 210.

American Society for Training and Development (ASTD). (2008). About Us. Retrieved November 17, 2008, from http://www.astd.org/ASTD/aboutus/

Atkinson, R. C., & Wilson, H. A. (1969). *Computer-assisted instruction: A book of readings.* New York: Academic Press.

Bannan-Ritland, B., Dabbagh, N., & Murphy, K. (2000). Learning object systems as constructivist learning environments: Related assumptions, theories and applications. In D. A. Wiley (Ed.), *The instructional use of learning objects.* Retrieved October 17, 2008, from http://reusability.org/read/chapters/bannan-ritland.doc.

Bloom, B. S., Englehart, M. D., Furst, E. J., Hill, W. H., & Krathwell, D. R. (Eds.). (1956). *A*

taxonomy of educational objectives: Handbook I. Cognitive domain. New York: David McKay.

Bradley, C., & Boyle, T. (2004). The design, development, and use of multimedia learning objects. *Journal of Educational Multimedia & Hypermedia, 13*(4), 371-389.

Christiansen, J., & Anderson, T. (2004). Feasibility of course development based on Learning Objects: Research analysis of three case studies. *International Journal of Instructional Technology and Distance Education.* Retrieved October, 17, 2008, from http://www.itdl.org/journal/Mar_04/article02.htm.

Churchill, D. (2007). Towards a useful classification of learning objects. *Educational Technology Research and Development, 55*(5), 479-497.

Churchill, D. (2008). Learning Objects for Educational Applications via PDA Technology. *Journal of Interactive Learning Research, 19*(1), 5-20.

Churchill, D., & Hedberg, J. (2008). Learning object design considerations for small-screen handheld devices. *Computers & Education, 50*(3), 881-893.

Cisco. (2003). Reusable learning object authoring guidelines: how to build modules, lessons, and topics (White Paper). Retrieved August 25, 2007, from http://www.e-novalia.com/materiales/104119_kbns.pdf

Cochrane, T. (2005). Interactive QuickTime: Developing and evaluating multimedia learning objects to enhance both face-to-face and distance e-learning environments. *Interdisciplinary Journal of Knowledge & Learning Objects, 1*, 33-54.

Cochrane, T. (2007). Developing interactive multimedia Learning Objects using QuickTime. *Computers in Human Behavior, 23*(6), 2596-2640.

Collis, B., & Strijker, A. (2001). New pedagogies and reusable learning objects: Toward a new economy in education. *Educational Technology Systems, 30*(2), 137–157.

Cook, C., Heath, F., & Thompson, R. L. (2000). A meta-analysis of response rates in web- or Internet-based surveys. *Educational and Psychological Measurement, 60*(6), 821-836.

Cook, J., Holley, D., & Andrew, D. (2007). A stakeholder approach to implementing e-learning in a university. *British Journal of Educational Technology, 38*(5), 784-794.

Creswell, J. W. (2003). *Research design: Qualitative, quantitative, and mixed methods approaches* (2nd ed.). Thousand Oaks: SAGE Publications.

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly, 13*(3), 319-340.

Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1989). User acceptance of computer technology: A comparison of two theoretical models. *Management Science, 35*(8), 982-1003.

Deutskens, E., de Ruyter, K., Wetzels, M., & Oosterveld, P. (2004). Response rate and response auality of Internet-based surveys: An experimental study. *Marketing Letters, 15*(1), 21-36.

Dodds, P., & Fletcher, J. D. (2004). Opportunities for new "smart" learning environments enabled by next-generation web capabilities. *Journal of Educational Multimedia and Hypermedia, 13*(4), 391-404.

Duval, E., Hodgins, W., Rehak, D., & Robson, R. (2004). Learning objects symposium special issue guest editorial. *Journal of Educational Multimedia and Hypermedia, 13*(4), 331-343.

E-learning Guild (2008). About Guild Members. Retrieved November 17, 2008, from http://www.elearningguild.com/content.cfm?selection=doc.65

Ely, D. P. (1990). The diffusion and implementation of educational technology in developing nations: Cross-cultural comparisons of Indonesia, Chile and Peru. *Instructional Developments, 1*(1), 9-12.

Farrell, K., & Carr, A. E. (2007). A blended model of instructional design for learning objects. In A. Koohang & K. Harman (Eds.), *Learning objects and instructional design* (pp.359-405). Santa Rosa, California: Informing Science.

Faugier, J., & Sargeant, M. (1997). Sampling hard to reach populations. *Journal of Advanced Nursing, 26*(4), 790-797.

Fletcher, J. D., Tobias, S., & Wisher, R. A. (2007). Learning anytime, anywhere: Advanced distributed learning and the changing face of education. *Educational Researcher, 36*(2), 96-102.

Fowler, F. J. (2002). *Survey research methods* (3rd ed.). Thousand Oaks, CA: Sage Publications.

Fraenkel, J. R., & Wallen, N. E. (2005). *How to design and evaluate research in education* (6th ed.). Boston: McGraw-Hill.

Griffiths, J. (2007). From course notes to granules: A guide to deriving Learning Object components. *Computers in Human Behavior, 32*(6), 2696-2720

Hodgins, H. W. (2002). The future of learning objects. In D. A. Wiley (Ed.), *The instructional use of learning objects* (pp. 281-298). Bloomington, IN: Agency for Instructional Technology Association for Educational Communications & Technology.

Howell, D. C. (2002). *Statistical methods for psychology*. Pacific Grove, CA: Duxbury.

Hsin-Yih, S., Shang-Hsien, H., & Yu-Hur, C. (2004). Integrating concept mapping into designing a course management system. *Journal of Educational Multimedia & Hypermedia*, *13*(4), 483-506.

Hudak, C. A. (2007). Linking instructional theories and instructional design to learning objects: A proposed conceptual framework. In A. Koohang & K. Harman (Eds.), *Learning Objects and Instructional Design* (pp. 1-38). Santa Rosa, California: Informing Science.

IEEE. (2002). WG 12: Learning objects metadata. Retrieved August 17, 2007, from http://ltsc.ieee.org/wg12/

Ilie, V., VanSlyke, C., Green, G., & Lou, H. (2005). Gender differences in perceptions and use of communication technologies: A diffusion of innovation approach. *Information Resources Management Journal, 18*(3), 13-32.

Ip, A., & Morrison, I. (2001). Learning objects in different pedagogical paradigms. In G. Kennedy & T. Petrovic (Eds), *Proceedings of ASCILITE 2001*. Melbourne: Melbourne University Press. Retrieved August 15, 2008, from http://www.medfac.unimelb.edu.au/ascilite2001/pubs/index.html

International Society for Performance Improvement (ISPI). (2008). About ISPI? Retrieved November 17, 2008, from http://www.ispi.org/content.aspx?id=208&linkidentifier=id&itemid=208.

International Society for Technology in Education (ISTE). (2009). About ISTE. Retrieved from http://www.iste.org/AM/Template.cfm?Section=About_ISTE.

Jonassen, D., & Churchill, D. (2004). Is there a learning orientation in learning objects? *International Journal on E-Learning, 3*(2), 32-41.

Kang, M., Lim, D. H., & Kim, M. (2004). Learning Designer: a theory-based SCORM-compliant content development tool. *Journal of Educational Multimedia and Hypermedia, 13*(4), 427-448.

Kay, R. (2007). A systematic evaluation of learning objects for secondary school students.

Journal of Educational Technology Systems 35(4), 411 – 448.

Kay, R. H., & Knaack, L. (2007a). Evaluating the use of learning objects for secondary school science. *Journal of Computers in Mathematics & Science Teaching, 26*(4), 261-289.

Kay, R. H., & Knaack, L. (2007b). Evaluating the learning in learning objects. Open Learning: *The Journal of Open and Distance Learning, 22*(1), 5 - 28.

Kay, R. H., & Knaack, L. (2007c). Teacher evaluation of learning objects in middle and secondary school classrooms [Electronic Version]. Retrieved September 29, 2008 from http://faculty.uoit.ca/kay/papers/LOES_Teacher_2007.pdf.

Kay, R. H., & Knaack, L. (2008a). An examination of the impact of learning objects in secondary school. *Journal of Computer Assisted Learning, 24* (6), 447-461.

Kay, R. H., & Knaack, L. (2008b). A formative analysis of individual differences in the effectiveness of learning objects in secondary school. *Computers & Education, 51*(3), 1304-1320.

Kerlinger, F. N. (1986). *Foundations of behavioral research* (3rd ed.). New York: Holt, Rinehart & Winston.

Kerr, S. T. (Ed.). (2003). *Toward a sociology of educational technology*. Mahwah, NJ: Lawrence Erlbaum Associates.

Ko, E., Kim, S. H., Kim, M., & Woo, J. Y. (2008). Organizational characteristics and the CRM adoption process. *Journal of Business Research, 61*(1), 65-74.

Koper, E. J. R. (2003). Combining re-usable learning resources and services to pedagogical purposeful units of learning. In A. Littlejohn (Ed.), *Reusing Online Resources: A Sustainable Approach to eLearning* (pp. 46-59). London: Kogan Pag.

Krauss, F., & Ally, M. (2005). A study of the design and evaluation of a learning object and

implications for content development. *Interdisciplinary Journal of Knowledge and Learning Objects, 1*, 1-22.

Lau, S.H., & Woods, P. C. (2008). An investigation of user perceptions and attitudes towards learning objects. *British Journal of Educational Technology, 39*(4), 685-699.

Laverde, A., Cifuentes, Y., & Rodríguez, H. (2007). Toward an instructional design model based on learning objects. *Educational Technology Research and Development, 55*(6), 671-681.

LearningTown. (2008). LearningTown. Retrieved November 17, 2008, from http://www.masie.com/

Leedy, P. D., & Ormrod, J. E. (2005). *Practical Research: Planning and design* (8th ed.). Upper Saddle River, New Jersey: Pearson Merrill Prentice Hall.

Liao, H. L., & Lu, H. P. (2008). The role of experience and innovation characteristics in the adoption and continued use of e-learning websites. *Computers & Education, 51*(4), 1405-1416.

Lim, C. P., Lee, S. L., & Richards, C. (2006). Developing interactive learning objects for a computing mathematics module. *International Journal on E-Learning, 5* (2), 221-245.

Lin, H. F., & Lee, G. (2006). Effects of socio-technical factors on organizational intention to encourage knowledge sharing. *Management Decision, 44*(1), 74-88.

Lukasiak, J., Agostinho, S., Burnett, I., Drury, G., Goodes, J., Bennett, S., et al. (2004). A framework for the flexible content packaging of learning objects and learning designs. *Journal of Educational Multimedia & Hypermedia, 13*(4), 465-481.

Lukasiak, J., Agostinho, S., Bennett, S., Harper, B., Lockyer, L., & Powley, B. (2005). Learning objects and learning designs: an integrated system for reusable, adaptive and shareable learning content. *ALT-J: Research in Learning Technology, 13*(2), 151 - 169.

Mavrommatis, G. (2008). Learning objects and objectives towards automatic learning construction. *European Journal of Operational Research, 187*(3), 1449-1458.

McCormick, R., & Li, N. (2006). An evaluation of European learning objects in use. *Learning, Media and Technology, 31*(3), 213-231.

McGee, P. (2006). Learning objects across the educational landscape: Designing for knowledge sharing and generation. *Educational Technology, 46* (1), 26-31.

Merrill, D. (2002). Knowledge objects and mental-models. In D. A. Wiley (Ed.), *The instructional use of learning objects.* Retrieved October 17, 2008, from http://reusability.org/read/chapters/merrill.doc.

Moisey, S. D., Ally, M., & Spencer, B. (2006). Factors affecting the development and use of learning objects. *American Journal of Distance Education, 20*(3), 143-161.

Muzio, J. A., Heins, T., & Mundell, R. (2002). Experiences with reusable E-learning objects: From theory to practice. *The Internet and Higher Education, 5*(1), 21-34.

Nesbit, J., Belfer, K., & Vargo, J. (2002). A convergent participation model for evaluation of learning objects. *Canadian Journal of Learning and Technology, 28*(3), 105-120

Northrup, P. T., Rasmussen, K. L., & Dawson, D. B. (2004). Designing and reusing learning objects to streamline WBI development. In A. M. Armstrong (Ed.), *Instructional design in the real world: a view from the trenches* (pp.184-200). Hershey, PA: Information Science Pub.

Nugent, G., Soh, L. K., & Samal, A. (2006). Design, development, and validation of learing objects. *Journal of Educational Technology Systems, 34*(3), 271 - 281

Parrish, P. E. (2004). The trouble with learning objects. *Educational Technology, Research and Development, 52*(1), 49-67.

Pata, K., Pedaste, M., & Sarapuu, T. (2007). The formation of learners' semiosphere by authentic inquiry with an integrated learning object "Young Scientist". *Computers & Education, 49*(4), 1357-1377.

Pershing, J., Ryan, C., Harlin, N., & Hammond, T. (2006). 2006 AECT membership salary survey. *TechTrends: Linking Research & Practice to Improve Learning, 50*(5), 10-19.

Porter, S. R., & Whitcomb, M. E. (2003). The impact of contact type on web survey response rates. Public Opin Q, 67(4), 579-588.

Quinn, C. (2000). Learning objects and instruction components. *Educational Technology & Society, 3*(2), 13-20.

Recker, M. (2007). A study of teachers' use of online learning resources to design classroom activities. *The new review of hypermedia and multimedia, 13*(2), 117-134.

Recker, M., Dorward, J., Dawson, D., Mao, X., Liu, Y., Palmer, B., et al. (2006, April). *Learning objects: Resources for teacher design?* Paper presented at the meeting of the American Educational Researcher Association, San Francisco.

Recker, M. M., Dorward, J., & Nelson, L. M. (2004). Discovery and use of online learning resources: Case study findings. *Educational Technology & Society, 7*(2), 93-104.

Rogers, E. M. (1995). Diffusion of Innovations (4th ed.). New York: The Free Press.

Rogers, E. M. (2003). Diffusion of Innovations (5th ed.). New York, NY: Free Press.

Rossman, G. B., & Rallis, S. F. (2002*). Learning in the field: An introduction to qualitative research* (2nd ed.). Thousand Oaks, California: Sage publications.

Sahin, I., & Thompson, A. (2006). Using Rogers' Theory to Interpret Instructional Computer Use by COE Faculty. *Journal of Research on Technology in Education, 39*(1), 81-104.

Schatz, S. C. (2005). Unique metadata schemas: a model for user-centric design of a

performance support system. *Educational Technology, Research and Development, 53*(4), 69-84.

Schibeci, R., Lake, D., Phillips, R., Lowe, K., Cummings, R., & Miller, E. (2008). Evaluating the use of learning objects in Australian and New Zealand schools. *Computers & Education, 50* (1), 271-283.

Seels, B., Fullerton, K., Berry, L., & Horn, L. J. (Eds.). (2003). *Research on learning from television*. Mahwah, NJ: Lawrence Erlbaum Associates.

Sherry, L., & Gibson, D. (2002). The path to teacher leadership in educational technology. *Contemporary Issues in Technology and Teacher Education, 2*(2), 178-203.

Slyke, C. V., Lou, H., & Day, J. (2002). The impact of perceived innovation characteristics on intention to use groupware. *Information Resources Management Journal, 15*(1), 5-13.

Sooknanan, P., Melkote, S. R., & Skinner, E. C. (2002). Diffusion of an educational innovation in Trinidad and Tobago: The role of teacher attitudes and perceptions toward computers in the classroom. *Gazette, 64*(6), 557-571.

Sosteric, M., & Hesemeier, S. (2002). When is a learning object not an object: A first step towards a theory of learning objects [Electronic Version]. *International review of research in open and distance learning*, 3. Retrieved August 26, 2008 from http://www.irrodl.org/index.php/irrodl/article/view/106/185.

South, J. B., & Monson, D. W. (2002). A university-wide system for creating, capturing, and delivering learning objects. In D. A. Wiley (Ed.), *The instructional use of learning objects*. Bloomington, IN: Agency for Instructional Technology Association for Educational Communications & Technology.

Spector, J. M., & Ohrazda, C. (2003). Automating instructional design: Approaches and

limitations. In D. H. Jonassen (Ed.), Handbook of research for educational communications and technology (pp.685-700). Mahwah, NJ: Lawrence Erlbaum Associates.

Sultan, F., & Chan, L. (2000). The adoption of new technology: the case of object-oriented computing in software companies. *Engineering Management, IEEE Transactions on, 47*(1), 106-126.

Surry, D. W. & Ely, D. P. (2002). Adoption, diffusion, implementation, and institutionalization of instructional design and technology. In R. A. Reiser & J. V. Dempsey (Eds.), *Trends and issues in instructional design and technology*, Upper Saddle River, NJ: Pearson Education.Tan, W. C., Aris, B., & Abu, S. (2006). GLOOTT Model: A pedagogically-enriched design framework of learning environment to improve higher order thinking skills. *Association for the Advancement of Computing in Education Journal, 14*(2), 139-153.

Taylor, S., & Todd, P. A. (1995). Understanding information technology usage: A test of competing models. *Information Systems Research, 6*(2), 144-176.

Wang, H. C., & Hsu, C. W. (2006). Teaching-Material Design Center: An ontology-based system for customizing reusable e-materials. *Computers & Education, 46*(4), 458-470.

Wiley, D. A. (2002). Connecting learning objects to instructional design theory: A definition, a metaphor, and a taxonomy. In D. A. Wiley (Ed.), *The instructional use of learning objects* (pp. 3-23). Bloomington, IN: Agency for Instructional Technology Association for Educational Communications & Technology.

Wiley, D. (2003). Coming collision between automated instruction and social constructivism. *Learning objects: Contexts and connections*. Retrieved August 28, 2007, from http://morty.uts.ohio-state.edu/learning_objects/documents/TELR-LO7screen.pdf

Wiley, D. A., Gibbons, A. S., & Recker, M. (2000). *A reformulation of the issue of learning object granularity and its implications for the design of learning objects*. Retrieved August 25, 2007, from http://reusability.org/granularity.pdf

Williams, D. D. (2002). Evaluation of learning objects and instruction using learning objects. In D. A. Wiley (Ed.), *Instructional use of learning objects* (pp. 173-200). Bloomington, IN Agency for Instructional Technology Association for Educational Communications & Technology.

Yahya, Y., & Yusoff, M. (2008). Towards a comprehensive learning object metadata: Incorporation of context to stipulate meaningful learning and enhance learning object reusability. *Interdisciplinary Journal of E-Learning and Learning Objects, 4*, 13-48.

Appendix A.

Survey Instrument: Research questions and data analysis

Research Questions	Survey Items	Data Analysis
Part I. Background Information		
What are the characteristics of organizations which adopted learning objects?	Type of the organization Organizational size	Descriptive statistics
Part II. Adoption Status of Learning Objects		
What is the adoption status of learning objects?	**Adoption Status**: What is the adoption status of learning objects in your organization? (a) My organization is currently using learning objects , (b) My organization is seeking additional information and/or exploring implementation of learning objects, (c) Not familiar with learning objects, (d) My organization is not using learning objects **Intentions to Use**: Please circle the option that best describes your organization's intended future use of learning objects. - My organization intends to increase the use of learning objects for work/learning in the future. - My organization intends to use learning objects in the future for the work/learning. **Actual Use**: In your professional role, please indicate your current level of usage of learning objects. (a) don't use at all, (b) use less than once each week, (c) use about once each week, (d) use several times a week, (e) use about once each day, and (f) use several times each day. **Project Based Use**: Please report your current level of usage of learning objects across projects. I currently use learning objects for	Descriptive statistics

	_____ (a) less than 25% of my projects, (b) 25%-49% of my projects, (c) 50%-74% of my projects, (d)75%-99% of my projects, (d)100% of my projects, (e) Do not currently use learning objects	
How adoption factors influenced the current use of learning objects?	Please provide the reasons for your current use of learning objects. **Perceived Usefulness** - Using learning objects makes it easier to design, develop and teach course content - Using learning objects enhances my effectiveness in designing, developing and teaching - Using learning objects increases my designing/developing/teaching productivity - Using learning objects helps me to accomplish designing/developing/teaching tasks more quickly - Learning objects are useful in my designing/developing/teaching **Perceived Ease of Use** - Learning to use learning objects was easy for me - I find it easy to get learning objects to do what I want them to do - My interaction with learning objects is clear and understandable - I find learning objects flexible to interact with - It is easy for me to become skillful at using learning objects - I find learning objects easy to use **Other Reasons** (i.e. your organization requires the use of learning objects.)	Descriptive statistics Qualitative method
Part III. Concepts of Learning Objects		
What is the current conceptualization of learning objects?	**Focus**: What do you think the definition of a learning object should focus on? (a) Technical aspects (b) learning aspects (c) a combination of the both (d) None of the above (Please explain). **Components**: How important do you think each of the below	Descriptive statistics Qualitative method

	components are in terms of the definition of a learning object? Please indicate your ranking for each item. (a) Digital resource (b) Reusability characteristics (c) Instructional support What other components should be considered when describing learning objects? (i.e. Small size, Self-contained, Metadata tagging, Scalability)	
Part IV. Utilization of Learning Objects		
How are learning objects currently being used across varying organizations?	**Current Utilization**: How are you currently using learning objects? (a) To automate the instructional design process (b) To aid instructional designers, developers and instructors in designing/developing/teaching courses (c) To empower learners to control over their own learning. (d) None of the above (Please explain)	Descriptive statistics Qualitative method
What design strategies are IDT practitioners adopting when using learning objects?	**Design Strategies**: Please indicate all the design strategies you are utilizing in your implementation of learning objects. (Check all that apply) (a) Create learning objectives for individual learning objects (b) Aggregate learning objects in a sequence from lower order to higher order learning outcomes (c) Embed feedback functions into learning objects to indicate students' performance (d) Provide concrete, authentic examples and problems (e) Embed interactivity features for learners to provide the solutions to problems presented (f) Encourage students to reflect on their own learning (g) Provide learning strategy support such as self-assessment questions, guides/hint, opportunities to review learning object content, and feedback on responses (h) Other strategies (Please describe other design strategies that you are using which are not listed above)	Descriptive statistics Qualitative method
	Please indicate the sizes of learning objects that you are currently using in your organization. (Check all that apply)	Descriptive statistics

(a) Asset: Single discrete unit of information such as text, image, sound, etc
(b) Combined media: Consists of content and a combination of optional media (image, sound, animation, etc)
(c) One complete instructional unit: Consists of several media. Might include learning objectives, content, practice, assessment, and additional media
(d) Module: Consists of several units
(e) Course: Consists of several modules
(f) None of the above (If none of the above describes the size of learning objects that you are using, please describe how your organization defines the parameters of a learning object):

What size of learning object do you use most frequently?
(a) Asset: Single discrete unit of information such as text, image, sound, etc
(b) Combined media: Consists of content and a combination of optional media (image, sound, animation, etc)
(c) One complete instructional unit: Consists of several media. Might include learning objectives, content, practice, assessment, and additional media
(d) Module: Consists of several units
(e) Course: Consists of several modules
(f) None of the above (Please explain):

What makes you use that size frequently?
(a) Easy to reuse in different contexts
(b) That is the minimal size that learning object system (content delivery system) in our organization affords
(c) The nature of learning topic (complexity level)
(d) Easy to customize for my own instructional contexts
(e) Others

Please rate the consistency of your use of granularity levels across projects.
I vary the granularity of the learning objects I use across different

projects.

Part V. Perceived Benefits of Learning Objects		
What are the perceived benefits of learning objects in terms of the overall support for instructional design and development, reusability, the time and cost effectiveness, motivation and interactivity features?	Please rate the following benefits of using learning objects. (a) Overall benefits: Learning objects are effective in supporting instructional design processes (b) Motivation: Learning objects are effective in motivating learners (c) Interactivity: Learning objects are effective in designing interactivity features for the program. (d) Cost: Learning object use decreases the development cost to create a new course (e) Time: Learning object use decreases the development time to create a new course (f) Reusability: Learning objects support the reuse of instructional context in flexible ways. (g) Please describe other benefits that you perceive when using learning objects.	Descriptive statistics Qualitative method

Appendix B

Survey Instrument

Introduction

This survey was designed to collect data on the current status of learning objects. Your participation and honest answers to the questions are very critical to understanding how learning objects are adopted, utilized, and perceived. The information from individual participants will be treated confidentially, and only summary results will be reported in the study.

If you have any questions, please contact:
Sunha Kim, Investigator (sunkim@vt.edu) or Dr. Barbara Lockee, Advisor (lockeebb@vt.edu).

Part I. Background Information on Participants and Their Organizations

1. Type of the Organization: Please indicate the type of organization you work for.

- ○ Higher education
- ○ Community college
- ○ K-12
- ○ Industry & Business
- ○ Military/Government
- ○ Non-profit
- ○ Other (Please explain): _____

2. Organizational Size: How many employees are in your organization?

○ 1–9	○ 10–19	○ 20–49	○ 50–99
○ 100–199	○ 200–499	○ Over 500	

3. Your Job Role: Please select the job role that best describes your current position.

- ○ Instructional Designer/ Developer
- ○ Instructor or Trainer
- ○ Faculty
- ○ Human Performance Improvement Specialist
- ○ Distance Education/ eLearning Program Administrator
- ○ Consultant
- ○ Instructional Systems Specialist
- ○ Teacher
- ○ Librarian/Information Specialist
- ○ Technology Coordinator
- ○ Other :_____

4. Years of Professional Practice: How long have you been engaged in designing, developing and/or delivering instruction?

○ 0-3 years	○ 4-6 years	○ 7-10 years
○11-14 years	○ 15-20 years	○ More than 20 years

5. Experience with Learning Objects: How long have you worked with learning objects?

_____ Years _____ Months _____ Weeks

Part II. Adoption Status of Learning Objects

1. Adoption Status: What is the adoption status of learning objects in your organization?

- O My organization is currently using learning objects
- O My organization is seeking additional information and/or exploring implementation of learning objects
- O My organization is not using learning objects
- O Not familiar with learning objects

2. Intentions to Use: Please circle the option to the right that best describes your organization's intended future use of learning objects.

Item	Scale					
	Strongly Disagree					**Strongly Agree**
2.1 My organization intends to increase the use of learning objects for work/learning in the future.	1	2	3	4	5	Don't know
2.2 My organization intends to use learning objects in the future for the work/learning.	1	2	3	4	5	Don't know

3. Actual Use: In your professional role, please indicate your current level of usage of learning objects.

- O don't use at all
- O use less than once each week
- O use about once each week
- O use several times a week
- O use about once each day
- O use several times each day

4. Project Based Use: Please report your current level of usage of learning objects across projects. I currently use learning objects for _____

- O less than 25% of my projects
- O 25%-49% of my projects
- O 50%-74% of my projects
- O 75%-99% of my projects
- O 100% of my projects
- O Do not currently use learning objects

5. Adoption Factors: Please provide the reasons for your current use of learning objects. Please check all that apply.

5.1 Perceived Usefulness

- O Using learning objects makes it easier to design, develop and teach course content
- O Using learning objects enhances my effectiveness in designing, developing and teaching
- O Using learning objects increases my designing/developing/teaching productivity
- O Using learning objects helps me to accomplish designing/developing/teaching tasks more quickly
- O Learning objects are useful in my designing/developing/teaching

5.2 Perceived Ease of Use

- O Learning to use learning objects was easy for me
- O I find it easy to get learning objects to do what I want them to do
- O My interaction with learning objects is clear and understandable

- ○ I find learning objects flexible to interact with
- ○ It is easy for me to become skillful at using learning objects
- ○ I find learning objects easy to use

5.3. Other Reasons (i.e. your organization requires the use of learning objects.):_____
_____

Part III. Definition of Learning Objects

1. Focus: What do you think the definition of a learning object should focus on?
- ○ Technical aspects
- ○ Learning aspects
- ○ A combination of the both
- ○ None of the above (Please explain): _____

2. Components: How important do you think each of the below components are in terms of the definition of a learning object? Please indicate your ranking for each item.

Components	**Scale** **Least Important**				**Most Important**
Digital resource	1	2	3	4	5
Reusability characteristics	1	2	3	4	5
Instructional support	1	2	3	4	5

What other components should be considered when describing learning objects? (i.e. Small size, Self-contained, Metadata tagging, Scalability) _____
_____

Part IV. Utilization of Learning Objects

These items assume that you are currently using learning objects.

1. Current Utilization: How are you currently using learning objects?
- ○ To automate the instructional design process
- ○ To aid instructional designers, developers, and instructors in designing/developing/teaching courses
- ○ To empower learners to have more control over their own learning
- ○ None of the above (Please explain): _____

2. Design Strategies: Please indicate all the design strategies you are utilizing in your implementation of learning objects. (Check all that apply)
- ○ Create learning objectives for individual learning objects
- ○ Aggregate learning objects in a sequence from lower order to higher order learning outcomes
- ○ Embed feedback functions into learning objects to indicate students' performance
- ○ Provide concrete, authentic examples and problems
- ○ Embed interactivity features for learners to provide the solutions to problems presented

- ○ Encourage students to reflect on their own learning
- ○ Provide learning strategy support such as self-assessment questions, guides/hint, opportunities to review learning object content, and feedback on responses

- ○ Other strategies (Please describe other design strategies that you are using which are not listed above): _____

3. Granularity levels

3.1. Please indicate the sizes of learning objects that you are currently using in your organization. (Check all that apply)

- ○ Asset: Single discrete unit of information such as text, image, sound, etc
- ○ Combined media: Consists of content and a combination of optional media (image, sound, animation, etc)
- ○ One complete instructional unit: Consists of several media. Might include learning objectives, content, practice, assessment, and additional media
- ○ Module: Consists of several units
- ○ Course: Consists of several modules
- ○ None of the above (If none of the above describes the size of learning objects that you are using, please describe how your organization defines the parameters of a learning object):

_____
_____

3.2. What size of learning object do you use most frequently?

- ○ Asset: Single discrete unit of information such as text, image, sound, etc
- ○ Combined media: Consists of content and a combination of optional media (image, sound, animation, etc)
- ○ One complete instructional unit: Consists of several media. Might include learning objectives, content, practice, assessment, and additional media
- ○ Module: Consists of several units
- ○ Course: Consists of several modules
- ○ None of the above (Please explain): _____

_____

3.3. What makes you use that size frequently?

- ○ Easy to reuse in different contexts
- ○ That is the minimal size that learning object system (content delivery system) in our organization affords
- ○ The nature of the learning topic (complexity level)
- ○ Easy to customize for my own instructional contexts
- ○ Other Reasons (Please explain): _____

_____

3.4. Please rate the consistency of your use of granularity levels across projects by circling the appropriate scale.

Item	Scale				
	Rarely				Often
I vary the granularity of the learning objects I use across different projects.	1	2	3	4	5

Part V. Perceived Benefits of Learning Objects

1. Benefits: Please rate the following benefits of using learning objects.

Item	Scale					
	Strongly Disagree					Strongly Agree
Overall benefits: Learning objects are effective in supporting instructional design processes	1	2	3	4	5	N/A
Motivation: Learning objects are effective in motivating learners	1	2	3	4	5	N/A
Interactivity: Learning objects are effective in designing interactivity features for the program.	1	2	3	4	5	N/A
Cost: Learning object use decreases the development cost to create a new course	1	2	3	4	5	N/A
Time: Learning object use decreases the development time to create a new course	1	2	3	4	5	N/A
Reusability: Learning objects support the reuse of instructional context in flexible ways.	1	2	3	4	5	N/A

Please describe other benefits that you perceive when using learning objects:_____
_____

Appendix C

IRB Approval

Office of Research Compliance
Carmen T. Green, IRB Administrator
2000 Kraft Drive, Suite 2000 (0497)
Blacksburg, Virginia 24061
540/231-4358 Fax 540/231-0959
e-mail ctgreen@vt.edu
www.irb.vt.edu
FWA00000572(expires 1/20/2010)
IRB # is IRB00000667

DATE: September 3, 2009

MEMORANDUM

TO: Barbara B. Lockee
Sunha Kim

FROM: Carmen Green

SUBJECT: **IRB Exempt Approval:** "The Conceptualization, Utilization, Benefits and Adoption of Learning Objects" , IRB # 09-637

I have reviewed your request to the IRB for exemption for the above referenced project. The research falls within the exempt status. Approval is granted effective as of September 3, 2009.

As an investigator of human subjects, your responsibilities include the following:

1. Report promptly proposed changes in the research protocol. The proposed changes must not be initiated without IRB review and approval, except where necessary to eliminate apparent immediate hazards to the subjects.

2. Report promptly to the IRB any injuries or other unanticipated or adverse events involving risks or harms to human research subjects or others.

cc: File

Appendix D

Example Survey Invitation Letter

Kim, Sunha

Subject: Invitation Letter to Dr.
Attachments: Informed_Consent_form.pdf

Dear Dr._____,

You are invited to participate in the survey on learning object. The survey will be used for the doctoral dissertation of Sunha Kim, a Ph D student in Instructional Design and Technology (IDT) program at Virginia Tech.

This study seeks to explore how IDT professionals perceive and use learning objects. You are expected to spend about 5-10 minutes to complete the online survey. Please find the below link to access the survey.

http://www.surveymonkey.com/s.aspx?sm=v775CAwAXww7rqmJvnycjA_3d_3d

Your participation and honest answer to the questions are very critical to enrich the body of knowledge on distance teaching and learning using learning objects. The information from individual participants will be treated confidentially, and only summary results will be reported in the study. This study has been approved by Virginia Tech's IRB# 09-637. Please refer to the informed consent form as attached.

If you have any questions, I would be happy to answer them. Thank you for your consideration.

Sincerely,

Sunha Kim
PHD candidate
Instructional Design and Technology
Virginia Tech