Considerations for Task Analysis Methods and Rapid E-Learning Development Techniques

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ABSTRACT
The purpose of this paper is to provide basic dimensions for rapid training development in e-learning courses in education and business. Principally, it starts with defining task analysis and how to select tasks for analysis and task analysis methods for instructional design. To do this, first, learning and instructional technologies as visions of the future were discussed. Second, the importance of task analysis methods in rapid e-learning was considered, with learning technologies as asynchronous and synchronous e-learning development. Finally, rapid instructional design concepts and e-learning design strategies were defined and clarified with examples, that is, all steps for effective task analysis and rapid training development techniques based on learning and instructional design approaches were discussed, such as m-learning and other delivery systems. As a result, the concept of task analysis, rapid e-learning development strategies and the essentials of online course design were discussed, alongside learner interface design features for learners and designers.

Keywords: tasks analysis, rapid e-learning training, e-learning design strategies

I. INTRODUCTION

Recent developments in instructional technology and multimedia learning environments indicate the need for new requirements or strategies for designers and developers who are responsible for developing project management and the planning of learning processes in education and industry. These strategies deal with conducting problem solving by employing instructional design models worldwide. According to the models, instructional design approaches essentially include conventional instructional system design (ISD) steps, which can be defined as design, development and evaluation as the basic steps in a model. Following on, ISD processes were defined as the analysis, design, development, implementation and evaluation stages, and also redefined as the ADDIE model and Spider Web Model (Piskurich, 2009).

Today, the model can be used effectively by designers and educators for their instructional and industrial project management processes for organizations. From this perspective, instructional design (ID) starts with planning and continues with needs assessment, and follows from instructional and task or job analysis to the evaluation stage. As such, the process of conducting instructional design and multimedia design learning projects can be extensive and time consuming. The projects can be viewed as e-learning training and learning activities in multimedia learning environments such as online, distance learning and mobile learning. The learning activities require task or job analysis procedures based on instructional design models.

Multimedia learning was derived from computer-based instruction theory, the applications of which include several instructional strategies and methods such as tutorials, drill-practice, simulations and tests, among others (Alessi and Trollip, 2001; İpek, 2001). Thus, multimedia learning development uses task analysis techniques to develop high quality instructional design for e-learning, online instruction and distance education. Using task analysis methods is also a vital stage for industrial design projects and instructional design for schools and companies. Task analysis is most often confused with needs assessment as a result of considering it a type or part of needs assessment (Rossett, 1987). In the project design process, the function of task analysis is to consider what content and jobs are. That is, each activity in multimedia design and e-learning instruction development defines contents and jobs for designers and educators as well as rapid instructional training by models. For this reason, task analysis methods should be clearly defined based on instructional training needs and goals in e-learning instruction. Task analysis technique classifies all responsibilities as human behaviours in order to complete instructional strategies such as skills, goals and tasks for designing multimedia projects (Ivers and Barron, 2010).

As a result, the paper discusses strategies between task analysis methods in instructional design and how to design rapid training in e-learning courses by using ID models. Thus, the purpose of this paper is to provide basic dimensions for rapid training development in e-learning courses in education and business. Chiefly, it starts with defining task analysis and how to select tasks for analysis and task analysis methods for instructional design in order to develop effective e-learning courses through the use of rapid training-instructional design models, and to determine following tasks or jobs in instructional process. The rest of the paper indicates performances as a framework for tasks to clarify goals, objectives, components of job skills and which tasks, skills or contents ought to be taught, and how media and learning environments should be selected. For this, domain of task analysis contains activity analysis, cognitive task analysis, learning analysis, job-procedural analysis and subject matter-content analysis (Jonassen, Tessmer and Hannum, 2009).

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II. What is Task Analysis?

Task analysis includes contents and jobs that are clarified and completed during instructional design and its projects. Task analysis functions concerns defining the contents and jobs in the instructional process, and rapid e-learning design or development of a course/courses. In this process, task analysis and instructional analysis can be designed at the same time and stage (Seels and Glasgow, 1998). Task analysis is the main part of designing courses and projects in education, industry and business. Designers and educators should effectively focus on task analysis procedures in their projects and on rapid e-learning development in the different work areas. Thus, selected task analysis methods and procedures should be used. There are several task analysis methods, including:

a. Job, procedural and skill analysis
b. Instructional and guided learning analysis
c. Cognitive task analysis methods
d. Activity-based methods
e. Subject matter-content analysis methods
f. Knowledge elicitation technique

Based on these task analysis methods, the domains of task analysis are shown in Figure 1 below.

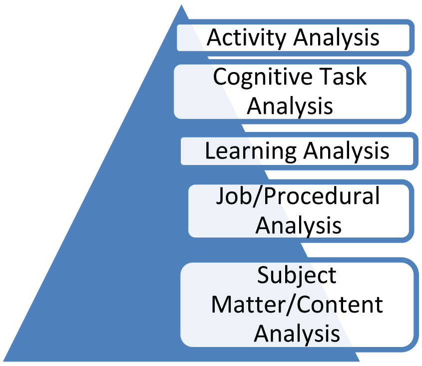

Figure 1: Domain of Task Analysis (adapted from Jonassen, Tessmer and Hannum, 2009).

Definition of Selected Task Analysis Methods

Job analysis is a broad category of processes derived from the industrial revolution. In industry, all tasks are defined as jobs that are performed by individuals. Industrial engineers used time-motion schedules, or Gantts techniques, to reduce jobs to their simplest activities, so that they could be learned quicker and performed more reliably (Jonassen, Tessmer and Hannum, 2009). Job analysis techniques can be effectively used for technical training. Technical skills are related to jobs that can be designed and developed by an instructional design model. The well known 4C/ID model is used for technical skills learning (Van Merriénboer, Clark and De Crook, 2002). Task analysis is most often confused with needs assessment. Task analysis, in other words job analysis, indicates a type or part of needs assessment (Rossett, 1987).

Some scholars have indicated in their models the difference between the needs analysis and need assessment that generates the needs for analysis. Several designers use these levels separately, thereby proposing that needs assessment can be defined as a part of problem analysis (Seels and Glasgow, 1998) and as such, that task and instructional analysis can be defined at the same stage. At this time, the problem analysis process presents needs assessment, performance analysis and gathering information or data for the decision making process in instructional design. Additionally, task analysis and needs assessment use the same knowledge tools. Task analysis, however, defines what must be learned in order to achieve goals. In brief, task analysis shows what the contents and jobs are that can be learned or trained.

Procedural, Job and Skill Analysis Procedures

Procedural analysis has been effective and useful in business and industry, where it is used to explain the job performance of labourers and well-skilled trainees. Instructional designers work with procedural analysis to describe work conditions, services and repair tasks in their actions. The process also describes performances, jobs or motor skills tasks, and analysis cognitive activities. These processes can be used for instructional design and training, as well as to describe job tasks in business, military and industry. The process is also analysed by three methods of task analysis: procedural processing, learning hierarchy and path analysis (Merrill, 1980). Functional job analysis (FJA) is a task analysis technique that focuses on what happens between what gets done on a job and what workers do to get the job done. The technique deals with worker activities in a job.

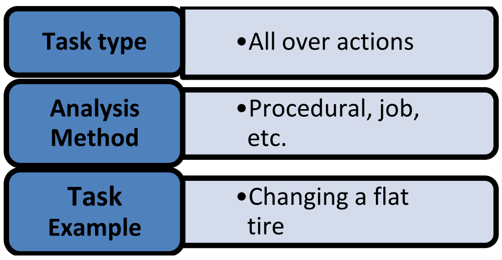

Figure 2. Continuum Task Analysis in Instructional Design.

Instructional Task Analysis Strategies

Learning hierarchy (prerequisites) analysis includes applying rules, concepts, solving problems and intellectual skills as prerequisite skills that facilitate learning of a higher skill. The analysis is often used for traditional instruction to describe learning levels before beginning a lesson and to define what must be taught, and the sequence in which to teach it. Each task has sub tasks in this process in order to reach the objectives in both simple and complex tasks. In addition, information processing analysis (IPA) describes task-related content, objectives or skills. This technique arose through development of behavioural psychology and current computer technology. With this method, all behaviours can be defined step by steps in a sequence to accomplish the task objective.

Learning contingency analysis (LCA) is a task analysis approach that is concerned with tasks in the learning environment, rather than with those associated with job skills and performance. The aim of the task analysis is to define behavioural parts of tasks and indicate the relationships among them. The relationships provide applications for teaching those tasks (Gropper, 1974). LCA also deals with using instructional strategies, which are defined as instructional content and conditions. In learning, these relationships can be shown by using X, Y and Z elements or behaviours. The process requires a significant amount of time, detailed analysis and a highly skilled analyst. As a result, it is a very time consuming analysis.

Cognitive Task Analysis Procedures

In cognitive task analysis (CTA) methods, there are goals, operators, methods and selection (GOMS) in a model, which is used for human-computer interaction activities as well as learning tasks in education. The second method in cognitive task analysis (PARI) consists of prediction, actions, results and interpretation levels. PARI can be used for analysing system knowledge, procedural knowledge and strategic knowledge in order to solve problems in real-life settings. PARI is also a useful approach for solving complex avionics and electronics systems problems (Hall, Gott and Pokorny, 1995). However, it requires expert problem solvers to conduct the analysis. The third cognitive analysis method is known as decompose-network-assess (DNA), which provides an easy procedure for eliciting knowledge and skills from experts and presents different types of information. The analysis deals with intelligent tutoring systems (ITS) as an automated tool. In addition, it can be used for designing an interface for the student-modelling approach, which is called SMART (Student Modelling Approach for Responsive Tutoring). With this process, DNA organizes knowledge structure and skills from subject matter experts and SMART uses, resulting in a knowledge structure for instruction (Shute, 1995). Thus, DNA relates to the "what" to teach, while SMART focuses on "when" and "how" to teach it. The rest of the cognitive analysis methods are cognitive simulations and case-based reasoning. Cognitive simulations are useful for computer programs and are applicable for mental constructs. In addition, GOMS was first defined by Newell and Simon (1972) and used for human information processing and mental processes in computer programs as an IF, AND, THEN process.

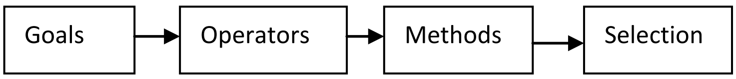

Figure 3: GOMS Analysis process

Activities for Tasks in Instructional Design

Activity-based methods of task analysis include activity theory, syntactic analysis, critical incident/critical decision methods (CIM) and task knowledge structures (TKS). These task analysis methods are more appropriate for analysing tasks and setting than as a framework for designing constructivist learning environments. In particular, activity theory is founded on the economic and political perspectives of Marx and Engels and the cultural psychology of Vygotsky, Leonti and Luria (Kuutti, 1996). Activity theory deals with the interaction of human activity and the human mind as whole. This is a framework for instructional design that is consistent with the growing ideas within the instructional design community and human-computer interaction activities. Activity theory provides us with an alternative way of viewing human thinking and activity for rapid instructional design processes, as well as for interactive interface design. The design system includes hierarchical levels of activity, such as activity-action-operation or motivate-goal-conditions for individual or group learning (Jonassen, Tessmer and Hannum, 2009). CIM is used to identify the critical components of job and skills and is used to support task analysis or needs assessment in the instructional design process. Task analysis structures (TKSs) are developed in order to identify and describe what people do in their work.

Subject-Matter and Content Analysis Procedures

In terms of subject matter/content analysis methods, several methods exist, such as the conceptual graph analysis (CGA), master design chart (MDC), matrix analysis (MA), the repertory grid technique (RGT) and fault tree analysis (FTA). Using these methods, CGA is a form of cognitive task analysis and is used to represent the structure of an expert's thinking. The methods take a significant amount of time to learn, but are applicable to a wide variety of domains. These include goal, action and concept as learning activity. Master design chart (MDC) is a task analysis approach for organizing whole lessons, curriculums and subject matter content, rather than job tasks in learning. This method can be used with instructional design models as a chart design process. In addition, matrix analysis (MA) can be used to identify relationships between and among concepts. There are contents and forms such as instructional variables for designing a matrix for learning. The approach was created to be the basis for developing programmed instruction and includes facts, concepts, principles and rules. It is also useful for the classification of tasks. Terminal objectives are written to define how to perform a task. As the last two techniques in this section, RGT is used to create a construct network by generating concepts, constructs and dimensions. FTA is effectively used to analyse the safety of systems, from industries to transportation. It is also used to analyse performance problems within a system as well as in military and industrial organizations. As knowledge elicitation techniques, documentation, observation, survey questionnaires, interviews, protocols, group interviews and the Delphi technique can be used for gathering information in training. Also it can be performed as actual settings (Jonassen, Tessmer and Hannum, 2009).

Instructional Training-Development and Task Analysis Methods

From the beginning of the systematic instructional design approach, basic steps in this approach are used for developing new instructional design models and activities in instruction. The basic steps in this approach can be effectively and efficiently used for designing rapid instructional development for e-learning courses in today's classrooms and organizations. Rapid development techniques

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(RDT) can be used and applied by delivery systems such as on the job training, asynchronous e-learning, synchronous e-learning, online learning, blended learning, self-directed learning, performance aids and mobile learning.

Rapid Instructional Design (RID) Approach and e-Learning Technologies

The RID process in instructional and training projects includes several steps that provide connections with e-learning technologies. These steps are:

a. Defining basic steps in instructional design and ADDIE
b. Rapid and effective e-Learning strategies and instructional design (Piskurich, 2006).
c. Rapid e-learning lessons-and-course development
d. Instructional technologies for the future century and rapid e-learning design process.

The ADDIE model contains analysis, design, development, implementation and evaluation. The instructional design model also works as a spider web model to indicate links between and among ID steps. The rapid instructional design approach has similar activities to the generic ADDIE model and other ID models. In addition, rapid development techniques (RDT) depend on the type of delivery system for instructional training for any purpose. The ADDIE model can be used as a rapid instructional design model for developing e-learning and distance education courses. In this process, the first activity is to complete the needed assessment and gathering information. The next activity is defining tasks or jobs in order to reach objectives. Thus, instructional designers and e-learning developers should follow all categories of each ID model without wasting time. ID teams should start with basic planning for the rapid instruction design process. To do this, games as a technique can be used for training or solving instructional problems (Piskurich, 2006, 2009). Rapid classroom course development includes objectives, content, expended outline and evaluation during the development process. All procedures in course development present content, instructor activities, objectives and media or e-learning tools. For future rapid instructional design (RID), all technologies such as flip charts, PowerPoint and video can be used with rapid course development techniques by using task analysis methods. As mentioned previously, on the job training (OJT) is itself a rapid development technique, as using it can reduce the need for both e-learning materials and instructor preparation. The RID process in OJT includes materials, objectives, preparing trainees, learning keys, expected results, work standards, sequence of activities, demonstration, performance and evaluation. Thus, all steps should be carefully designed with simulations, subject-matter experts and equipment for RID. These procedures in e-learning design or development present performance activities with task analysis techniques for rapid instructional design (RID) in the future.

Rapid Instructional Design (RID) for Mobile Learning and Future Delivery Systems

Designing successful e-learning is based on real-world contexts, which can be drawn from experience with organizations that are searching for ways to be effective with e-learning. There are several design principles for organizations, including visual and learner interface designs. The principles in visual lesson design and learner interface design can be work as guidance and originate from a traditional instructional design approach. Some principles came from personal attitudes and preferences for designing e-learning instruction. The instructional design process takes a long time and requires high level performance in the development of e-learning processes and mobile learning. Mobile learning is defined as "handheld technologies, together with wireless and mobile phone networks, to facilitate, support, enhance and extend the reach of teaching and learning" (Ashridge, 2011, p.2). Mobile devices can be used for a range of learning activities related to different types of learning (Wang, and Shen, 2012); for example, recording information, assessment, images, applications, collaboration, context-location, games-simulations, reading, audio, polling, searching, support and coordination, all of which are important activities in the mobile learning context (Ashridge, 2011).

Learning activities work for online learning. And e-learning process works as continuum and indicates Dale's (1969) aspects. Increasingly, people appear to remember more from reading through simulation and games, while instructional design performance appears less geared toward e-reading and more to e-learning (Allen, 2007).

Thus, the RID approach for mobile learning and other delivery systems should be used for simulations, content, knowledge management and beta test applications in order to develop high level e-learning designs in the future.

III. CONCLUSIONS

With new technologies in the e-learning design process, instructional designers, software developers and educators should be aware of the rapid instructional design approach and the idea of task analysis performance. This awareness is very important for instructional job-based training and other task analysis methods for the development of training programs for schools, companies and industrial organizations without wasting time. This approach also works with online course design and multimedia learning projects. It also provides benefits for designers through learning theories and instructional design models. The rapid instructional design (RID) process uses human-computer interaction activities for designing visuals, text and learner-user interface design variables to develop future e-learning courses by applying different types of task analysis methods. Learning strategies in rapid e-learning development should focus on the instructional design model and its categories in order to develop effective online, multimedia learning projects that can indicate input, activity and learning outcomes. As such, using task analysis methods after completing a needs assessment is vital for designing effective, efficient and engaged instructional programmes and e-learning course development. Thus, experts in the field of instructional design and technology should indicate to users and learners the importance of analysing tasks, and using task analysis methods for rapid instructional design (RID) and rapid e-learning development.

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