Levels of Cognition of Instruction and of Students’ Reflective Thinking in a Selected Web-Enhanced Course

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Abstract

The development of cognitive instruction, critical thinking, higher level of thinking and problem solving ability have been of great concern in the recent past. Based on the cognitive education literature, a successful distance education program should be able to provide high quality instruction. One way to examine the quality of instruction would be to assess the cognitive levels of the web-based distance education program.

In this study, the modified version of Newcomb and Trefz’s taxonomy was used to assess the level of cognition of teaching materials of the web-based course. They developed a modified version of Bloom’s taxonomy, which included four specific levels: remembering, processing, creating, and evaluating. The purpose of this study was to describe and compare the cognitive level of instruction of one selected web-enhanced course and the cognitive level of students’ reflective thinking.

Findings of the study indicated that the “processing” level was the most commonly utilized level in the classroom and in the on-line environment. A training program is recommended for teachers who will teach a web-enhanced or web-based course. The program should contain: (1) the familiarity with the technology, (2) on-line class management skills and (3) pedagogical training, such as: higher cognitive level of teaching and the objective classification system. A future study was suggested to observe some other aspects of communication between teachers and students other than on-line course content and discussion forum, such as: chat room, emails, or some other communication channels.
**Introduction**

Distance learning has become a hot topic in the past few years. Microcomputers, the Internet, and the World Wide Web (WWW) are shaping the current generation of distance learning, and virtual reality, artificial intelligence, and knowledge systems may be next (Kerka, 1996). Saba (1999) stated that one of the most important implications of distance learning is that students must take more responsibility for their learning. The WWW has become one of the most popular methods of disseminating distance learning programs. For educators, a benefit of the Web is that the types of information that can be used in a course are almost limitless. Because the information is stored electronically, learners with access to the site can download or use online the information as long as it is stored there. That makes it easy for learners to work at their own pace and to visit the site as frequently as they like, whenever they have time (Porter, 1997).

Distance education has been expected to perform its educational role more efficiently and effectively than traditional education. A successful distance education program should be able to provide high quality instruction. One way to examine the quality of instruction would be to assess the cognitive levels of the web-based distance education program.

**Purpose of the Study**

The purpose of this study was to describe the cognitive level of instruction of one selected web-based course and describe the cognitive level of students’ reflective thinking of the same course at The Ohio State University. To achieve the purpose of the study, three research objectives are proposed to:

1. Describe the levels of cognition of the teaching materials of selected web-based courses.
2. Describe the levels of cognition of students’ reflective thinking of the teaching materials.
3. Compare the levels of cognition of the teaching materials and levels of cognition of students’ reflective thinking.

**Procedures**

The procedures of this study included two parts. One was to assess the cognitive level of teacher’s instruction in five aspects and the other part was to collect cognitive level of students’ reflective thinking.

**Teaching materials (Instruction)**

**Population and Sample**

The target population for the study consisted of the web-based courses in the distance education program (TELR) at OSU. Due to practical limitations of time, money and professors’ agreement to participate, one sample course was selected purposively.

**Measuring cognitive level of instruction**

In this study, the modified version of Newcomb and Trefz’s taxonomy was used to assess the level of cognition of teaching materials of the web-based course. Newcomb and Trefz (1987) developed a modified version of the taxonomy, which included four specific levels:
1. Remembering
2. Processing
3. Creating
4. Evaluating

The researcher adopted Newcomb and Trefz’s taxonomy to identify the actual levels of cognition of instruction of the teaching material on the web pages.

Validity

The validity of the classification system, which was developed by Newcomb and Trefz (1987), was based on the fact that it was derived from Bloom’s Taxonomy of Educational Objectives: Cognitive Domain (Miller, 1989; Whittington, 1991; Chen, 1994 and Dlamini, 1996). Since Bloom’s Taxonomy has been used widely by researchers to assess cognition, the classification system developed by Newcomb and Trefz is also considered valid.

Reliability

Reliability of the instrument was based on the rater’s utilization of the instrument. By using the Newcomb and Trefz’s classification system, teachers’ cognitive level of instruction were observed and assessed as soon as the teaching materials were completely posted on the web. After one week, the researcher observed and assessed the same teaching materials again. An intra-rater reliability was calculated by computing the percent of agreement upon the two ratings of the same teaching materials.

Students’ reflective thinking

Population and Sample

The population of this study consisted of thirteen graduate students, who enrolled in the selected web-enhanced course at OSU during the Spring Quarter of 2001. Due to the specific purpose of the research, a census interview was conducted to all the students.

Assessing level of students’ reflection of the instruction—Think aloud protocol

The think-aloud protocol is one type of verbal reporting method in which the researcher provides a task and asks subjects to say aloud everything that comes to mind as they are performing it (Wade, 1990).

Validity

Ericcson & Simon (1993) stated that verbal reports can be, and should be, understood in exactly the same way as we understand other kinds of response. Thus, one could assume face validity of this technique was valid, because students were to reflect upon the instruction of the web-based courses and express their thoughts that accused during the think-aloud process with the researcher.

Reliability

The reproducibility of data on repeated test occasions is critical to its interpretation. An obvious approach to showing reproducively is to give the same subjects the same tasks on several occasions and then compare the verbal reports (Ericcson & Simon, 1993). In this study, the researcher conducted a pilot study to establish reliability.
Findings and Results

Objective 1. To describe the levels of cognition of the teaching materials of a selected web-based course, in terms of the following selected aspects: course objectives, in-class discourse, on-line course content, and out-class assignments

The “Processing” level was utilized most frequently (46.6%) in the instruction and the “remembering” (18%), “creating” (19.4%) and “evaluation” level (16%) were utilized pretty much equally in this course.

Objective 2. To describe the levels of cognition of students’ reflective thinking of the teaching materials

The “Processing” level was utilized much more frequently (56.5%) than other three levels: “remembering” (6.25%), “creating” (18%) and “evaluation” levels (19.25%) in students’ thoughts.

Objective 3. To compare the levels of cognition of the teaching materials and levels of cognition of students’ reflective thinking

The most common cognitive level utilized by both teachers and students were “processing” level (40% and 56.5%). The “Remembering” level was utilized last frequently of both of them (19% and 6.3%). The percentages of both teachers’ and students’ cognitive level are equally distributed in the “creating” (20% and 18%) and “evaluation” level (21% and 19.2%).

Conclusions and Recommendations

The following conclusions are draw from the findings and based upon the researcher’s interpretation of the results of the study.

Conclusion 1
In this study, “processing” level was expected to be utilized most frequently based on the course objectives and this level was assessed to be utilized most frequently in the classroom, on-line course content and discussion forum. However, out-of-class assignments were assessed to offer more opportunities of higher order thinking for students.

Conclusion 2
In this study, the majority (40%) of the overall instruction was attained at the “processing” level. Each of the “remembering” level, “creating” level and “evaluation” level was utilized equally around 20%.

Conclusion 3
The distribution of the cognitive level delivered by the overall instruction pretty much correspond to the distribution of cognitive level which the course objectives intended to reach.

Conclusion 4
The cognitive level of students’ reflective thoughts in this study was mainly assessed at the “processing” level and the percentage of students’ reflective thoughts at the “remembering” is very low (6.3%).

Conclusion 5
In the on-line discussion forum, the percentage of teachers’ responses at the
“remembering” level was 3% and the percentage of students’ reflective thoughts at the “remembering” level is lower than 2%. The results showed that discussion forum offered more opportunities in higher order thinking.

Conclusion 6

The majority (56.5%) of the overall students’ reflective thoughts were attained at the “processing” level. According to the interview results and the comments students posted on the discussion forum, the “application” category in the Florida Taxonomy of Cognitive Behavior was the most common checked category. The results showed that the participants in this study applied the knowledge to their own practical situation very often.

Conclusion 7

“Processing” level is the most common cognitive level utilized in both overall instruction and in students’ reflective thoughts. The “remembering” level was utilized least frequently both in instruction and students’ thoughts.

Conclusion 8

In general, little difference existed between the distributions of assessed cognitive level of in-class discourse and assessed cognitive level of on-line course content. The “processing” level was most commonly utilized in both of them.

Conclusion 9

The “Creating” level is the most common cognitive level utilized in out-of-class assignments. This study showed that out-of-class assignments attained a higher cognitive level than in-class discourse and on-line course content.

Conclusion 10

In general, on-line course content was not assessed to attain higher cognitive level than in-class discourse; however, on-line discussion was assessed to attain a very low percentage at the “remembering” level, which was the lowest cognitive level of thinking. The results showed that the on-line discussion forum might offer more opportunities in higher order thinking.

Recommendations

Based on the conclusion of this study and the literatures on teaching and learning on higher cognitive level, specific recommendations are made for the professors who will teach a web-enhanced course and for future studies.

Recommendations for the web-enhanced instruction

1. Kerka (1996) noted that lacking of nonverbal cues can create misunderstanding in distance education, but communication protocols can be established and relationships among learners can also be developed. If in-class instruction is feasible for both teachers and learners, a web-enhanced course is more recommended than a web-based course. In a web-enhanced course, teachers and students could have face-to-face communication in the classroom and also have the on-line communication protocols, such as: discussion forum, chat room and e-mails, when outside the classroom.

2. Assignments are always an effective way to encourage students to have higher cognitive level thinking. Teachers should also use assignments to establish participation, especially in a web-based course.
3. The absence of motivation will make a simple learning task hard to achieve (Bigge & Hunt, 1968). In the teaching and learning process, teachers have to initiate and maintain the interest of students by meeting their needs, wants and interests. A need assessment or background knowledge probe is recommend before class.
4. Truman & Hartman (1998) described that course production is best done when the faculties have taken sufficient time to examine their pedagogical goals. Gall (1970) stated that the lack of effective teacher training programs lead to lower cognitive level instruction. Truman & Hartman (1998) also stated that provision of adequate campus infrastructure ensures equipment, software and production support to prevent faculty from feeling frustration if they have made a sincere commitment to teach on-line. Thus, a training program or a workshop, which contains both pedagogical development and effectiveness of technology, for teachers who will teach a web-based or web-enhanced course is needed.
5. Cognitive theory deals with the problem of how people gain an understanding of themselves and their environments, and how people act in relation to their environment by using their cognition. In order to improve the learning outcomes of students, teachers in every area need to have a basic understanding of the psychological reaction during the teaching and learning process.
6. Teachers must understand that the purpose of teaching should be the development of thinking rather than acquiring knowledge in terms of facts (Bruner, 1971). Learners can not learn all the facts and information that are presently available. What is important is that they develop structures to understand, integrate and transfer knowledge.

**Recommendations for future studies**

1. A future study is needed to observe some other aspects of communication between teachers and students other than on-line course content and discussion forum, such as: chat room, emails or some other communication channels.
2. This course was a pedagogical course, thus, the instructors emphasized the principles of teaching and learning and the educational objective classification systems. A future study should examine courses in some other area, for example: technical courses, and compares the results across studies.
3. Future research needs to be replicated in different setting. Similar study needs to be conducted in a web-enhanced or web-based course in the Extension Education Programs or in the College of Food, Agricultural, and Environmental Sciences.

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