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Integrating Case-Based Reasoning Approach in an Undergraduate Industrial Technology Research Course

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Abstract

In recent years educators in industrial technology education have been recognizing the need for undergraduate students to enter the competitiveness with a set of research competencies. Numerous industrial technology research courses have not been established learning innovation to adapt previous experience for promoting students' performance. This paper reviews recent research on learning innovation, mostly in the context of educational innovation and students' professional development. A systematic literature and journal search has been done in the Science Direct database to identify key empirical studies in integration with theoretical notions about students learning innovation with CBR or about other components of these innovations. Both design and implementation is integrated along the case-based reasoning and contemplative learning task to generate a model of students' knowledge representing on experience in industrial technology research course of Undergraduate Mechanical Technology Program at Faculty of Industrial Technology, Nakhon Si Thammarat Rajabhat University. The result is identified the learning process comprising index assignment, retrieve, reuse, revise, retain, and outputs. It is concluded that this study develops a learning process based on exact functional industrial technology research to increase students' research competitiveness.

Keywords: Case-based reasoning, Cognitive domain, Contemplative learning task, Industrial technology research, Learning innovation

Introduction

In recent years educators in industrial technology education have been recognizing the need for undergraduate students to enter the competitiveness with a set of research competencies.Numerousindustrial technology research courses have not been established learning innovation to adapt previous experience for promoting students' performance. Case-based reasoning (CBR) is a discipline of analogical reasoning that emphasizes need for reasoning based on previous experience (Jonassen &Hernandez-Serrano, 2002; Jonassen, 2004; Kolodner, 1993; Riesbeck & Schank, 1989). The. previous experience means understanding suggest a solution to solve a new problem or a way of interpreting a situation, which allow the potential influences of a proposed solution to be predicted. In order to adapt learning innovation in an undergraduate industrial technology research course of Mechanical Technology Program (MT) at Faculty of Industrial Technology (FIT), Nakhon Si Thammarat Rajabhat University (NSTRU), the research issues have developed on the CBR journey as a method of applying theory into practice in the learning tasks. Despite this considerable evidence, research into how CBR can promote future problem-solving strategies as an analogical reasoning process has been limited in MT students. Once these students perform the research context, they will encounter situations that require the development of innovative solutions to complex research problems.

Therefore, researchers search a method in which problem-solving strategies were involved. Given the new solution of research practice, a dearth of innovation to this transformer is of concern. Students have been studying in vocational and technical education, but they cannot adapt previous beneficially experience for knowledge representative to develop research competitive in MT areas. The skills and techniques of traditional expertise, particular as the MT program at NSTRU is being in the traditional learning process, employ a conventional method of delivering individuated students consisting of text book and assignment. With this problem solving, the learning process have not been given this mismatch between the kinds of problem solving being performed in trends of contemporary research settings and the needs of community-based research used to solve problems in industrial technology research course. CBR is viewed as a process of problem solving remembering a specific problem-solving episode, adapting the solution to fit the current situation and storing the adapted solution in the memory. Researchers can be applied new innovations as the learning task and models for designing learning environment are needed. That is, each of this model support students how to solve problems with the adapted solution; indexed as new research cases into practitioners' memory for future use (Kolodner, 1996). In order to solve, the accumulation of the research cases generates to demonstrate the knowledge acquisition of the students' expertise

Objective

The aim of this paper is to review the existing literature and journals on how students learn in learning tasks of industrial technology research course.

Theoretical Framework

Analogical reasoning of CBR in industrial technology research course Deriving, in the CBR paradigm, mean adapting previous solutions to meet current demands; using previous cases to solve current situations; using previous cases to critique current solutions; and or development derived reasoning from create an equitable solution to a new problem. Interpreting an experience means creating an explanation that connects one's goals and actions with resulting outcomes. Such deriving depends high extensively upon students ability to create such explaining, suggesting that the ability and need to explain are key to promoting the research competitiveness in this paper.

CBR views analogical reasoning as the mental model of our ability to define the powerful learning strategies. Actually, previous experience and knowledge to bear in the art of mechanical technology requires knowledge, skills and expertise and central to effective practice is ability to problem solving (Kolodner, 1993; Riesbeck & Schank, 1989, 1991). The state of the art in industrial technology research course have extending ones' knowledge by incorporating new experiences into memory, by re-indexing old experiences to make them more accessible, and by abstracting out generalizations from experiences.

The CBR approach is based upon a model of cognition that:

1.Treats concrete experience (concrete, specific knowledge as opposed to abstract, general knowledge) as primary to learning to solve problems;

2.Exposes practitioners' to new experiences; and

3.Integrates the factors of dynamic memory, reasoning, and practicing.

Additionally, a query describing a target problem is natural, analogical reasoning cycle, stories of concrete problem-solving experience retrieved from dynamic memory (analogs) are adapted to interpreting and solving a new problem (Aamodt & Plaza, 1994; Jonassen, Tessmer, & Hannum, 1999; Kolodner, 1993; Jonassen, 1997, 2000, 2004; Kolodner & Leake, 1996). The problem solving experience affects dynamic memory by generating a solution, new story which is used in future. As a result, dynamic memory involves with the integration of each new story.

Conceptual framework of CBR

In CBR, all the problems are represented as cases, which were defined by Kolodner and Leake (1996) as: "A case is a contextualized piece of knowledge representing on experience that teaches a lesson fundamental to achieving the goals of the reasoner." A case usually has two major parts: the problem itself with the context describing the environments it should be retrieved; and the solution of the problem or the lesson it will teach. CBR can be seen as a 4 RE's systematic process: **Retrieve Reuse, Revise** and **Retain**. This system is cited in Figure 1 can be represented as follows:

1.Retrieve: the system searches and retrieves the case(s) most similar to the problem case, according to a predefined similarity measure.

2.Reuse**:** the user evaluates it in order to decide if the solution retrieved is applicable to the problem.

3.Revise**:** if it cannot be reused, the solution is revised (adapted) manually (by the user) or automatically (by the CBR system).

4.Retain**:** the confirmed solution is retained with the problem, for future reuse, as a new case in the database.

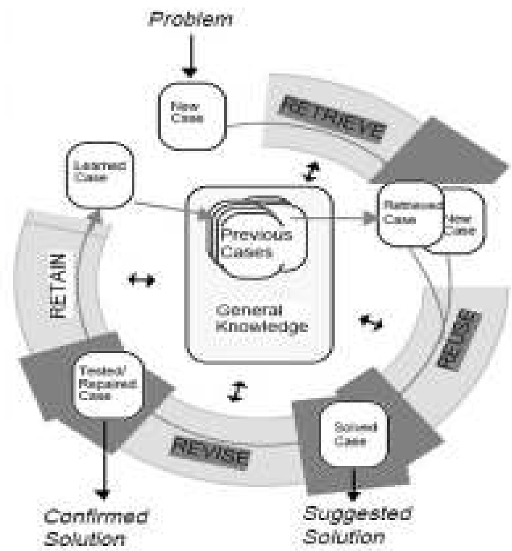

Figure 1 The CBR system (Aamodt and Plaza, 1994)

CBR usually concerns the following issues so that different components can work co-operatively, contributing to efficient and effective system performance. A vast amount of work has been carried out concerning a wide range of issues and different techniques in CBR (Mantaras & Plaza, 1997). Although the CBR cycle is a retrieve-evaluate-adapt-learn process, a CBR system may very well implement only the retrieve step, as this is the expression of the concept of reuse of experience. The difference between a database search and CBR *retrieval* is that the latter employs searching mechanisms that are based on classification and decision tree algorithms, or on assessment of the similarity of cases using predefined similarity measures

Designing of the contemplative learning task model via CBR

According to the CBR approach, the crucial factor that sets experts apart from students is the ability of experts to deal effectively with new situations by recalling and reusing the relevant experience. Therefore, Jonassen (2004) argued that CBR is thought to be valuable to fit problem-solving strategies as a forward planning performance or skill involving cognitive processes.

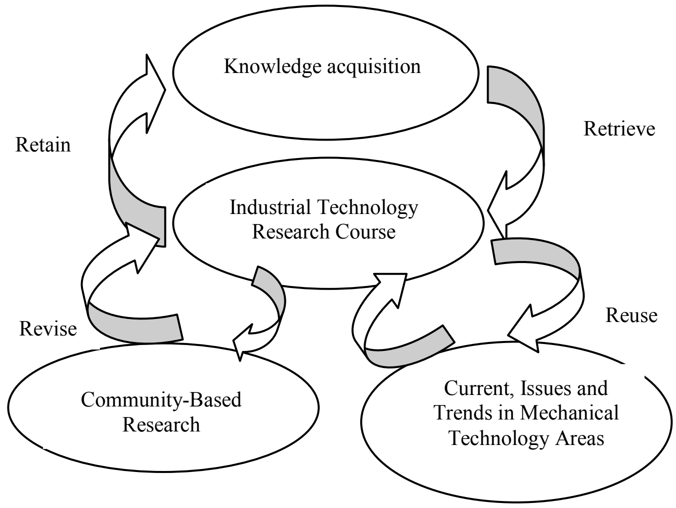

Figure 2 Contemplative learning task model via CBR

Researchers employ suggested that generated CBR process emphasizes the performance of analogical reasoning and the feedback of evaluation in order to use a case-based reasoned to its lessons while adding a new experiential.

In Figure 2, a particularly illustrative content of a CBR is the knowledge represent product (Jonassen, 2000; Jonassen & Hernandez-Serrano, 2002**)**. The activities has associated with the students' explains how the CBR method support complex research problem-solving skills is based upon a model of cognition. (Aamodt & Plaza, 1994; Ausubel, 2000; Jonassen, Tessmer, & Hannum, 1999; Kolodner, 1992, 1993, 1996; Kolodner & Leake, 1996; Leake, 1996; Riesbeck & Schank, 1989, 1991).

Method

A systematic literature and journal search has been done in the Science Direct database to identify key empirical studies in integration with theoretical notions about students learning innovation with CBR or about other components of these innovations. Search combinations used were 'case-based reasoning' in combination with 'learning innovation' and 'learning tasks' or 'learning approach' or 'learning activities' (including synonyms for all search terms).

This resulted in a set of 24 articles. The articled included in this review matched the criteria that researchers were empirical studies aimed at revealing industrial technology research course. Studies describing theories, analogical reasoning, and effects of specific learning tasks on the different context of students learning innovation in university with learning were taken into account.

Researchers collected data have had the following;

First, analogical reasoning cycle, stories of concrete problem-solving experience retrieved from dynamic memory (analogs) are adapted to interpreting and solving a new research problem with knowledge acquisition.

Second, students decide if the solution retrieved is applicable to the research problem in the current, issues and trends in mechanical technology areas.

Third, students revise how CBR have powerful and advanced; knowledge acquisition from community-based research and constructionism explains how concrete, hands-on activities and experience facilitate the information of these knowledge constructions, a model and defined process.

Finally, CBR approach offers that the contemplative learning task model and process and is discussed in retain.

Implementation

Integration of CBR and the contemplative learning task model in industrial technology research course

By utilizing previous similar cases to solve, explain, or interpret a current problem the CBR method simulates students' problem solving strategies. When facing a new case, individuals normally use their early experiences solve a new problem. The CBR method utilizes a database to store previous cases to help students to solve problems. Figure 3 illustrates the CBR framework (Aamodt and Plaza, 1994).

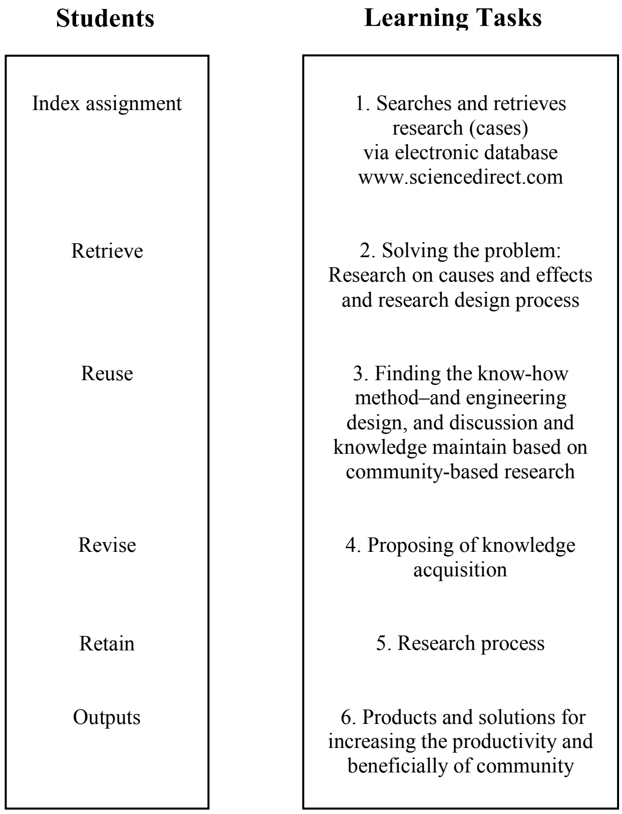

Figure 3 Integration of CBR and the contemplative learning task model in industrial technology research course

The implication of learning innovation via CBR

The implication of learning innovation via CBR is described in the following steps.

1. Index assignment: Indices are assigned to cases based on its features. Researchers assign searches and retrieves research (cases) via electronic database www.sciencedirect.com. The description can be numerical values, words, or diagrams. Proper case classification helps the system to locate similar cases.

2. Case retrieval: After users describe a new problem, the index system searches for similar cases in the database based on the predefined matching algorithms by using critical thinking skills. A scenario in which the case with the highest value is retrieved and its solution, and is directly proposed to students know causes and effects and research design process.

3. Case reuse: When a case is retrieved, students can evaluate whether the proposed solution is viable. If the solution matches the target problem perfectly, the know-how method and the engineering design for case solution is the answer to the problem. However, the case solution only occasionally matches its features directly to a certain extent. Moreover, a gap arises between a problem and the solution that must be revised. Then, discussion and knowledge maintain is based on community-based research.

4. Case revise: This step is also called modification. Among the many ways to revise the retrieval case include use of heuristics, students' intervention, domain-

specific knowledge and integrating to generate knowledge acquisition.

5.Case retain: When a satisfactory solution is obtained, the newly solved problem and all information, including strategies for repair, implement action and other features, are stored in the database as a new case. Doing so significantly increases the ability of the system ability to employ in research process.

6.Outputs: Products and solutions for increasing the productivity and beneficially of community.

In terms of inventive problems, the knowledge acquisition for solving problems in CBR normally belongs to incremental innovation (Leake, 1996). Importantly, new knowledge that originates from other technical domains should be introduced to raise it to the learning innovation (Robles et al., 2009; Sudsomboon & Anmanatrakul, 2010).

This study is introduced since it refuses to compromise during problem solving, provide universal ways to solve problems and enable students to devise innovative solutions.

Conclusion

The contemplative learning task model via CBR and integration model proposed in this study provided a relatively easy means of transferring a solution from a previous experience corresponding research problem to a new research problem. Since CBR searches for solutions in a certain domain, the proposed approach introduces students' to devise research problem-solving skills and solution strategies that are applicable across mechanical technology areas.

An inventive principle of this paper proposes a learning innovation model to lead learning designers systematic to break through learning limitation of design and innovative learning abilities design. Previous cases from a database support a novel design to satisfy functional students' research performances under the CBR framework. The new solution with its functional characteristics will be stored in the database of CBR to increase the effectiveness of solving future research problems.

This paper develops a learning process based on exact functional industrial technology research to increase students' research competitiveness. Future research should conduct the contemplative learning task model via CBR and integration model that are applicable to the proposed model. Further effort should also be devoted to applying the proposed model to design other globally renowned students' research competitiveness.

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