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Effective Alignment between University Education and Teaching Practice through Automatic Interpretation of Lesson Plans

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Abstract: We have built an instructional design support system called "FIMA-Light" which reasons about teacher's intentions from his/her lesson plan and automatically produces I_L event decomposition trees. In this paper, we discuss a particular use of I_L event decomposition trees produced by FIMA-Light in a teacher education program. First, we consider effective alignment between teacher education at university and teaching practice in the classroom. We also report on trial use of FIMA-Light in teacher education at university in order to investigate the usability of the information expressed by I_L event decomposition trees.

Keywords: Instructional Design, Ontology, Teacher Education, Teachers' Professional Ability

1. Introduction

It is important to improve teacher education programs in keeping with changes of social needs. In Japan, the Central Education Council (2006) published a report about how teacher education should be conducted in the future. This report states that various teaching practices in schools aligned with teacher education provided at university, such as lectures, play the most important role in improving the quality of teacher education programs. In this study, we examine the ability of teachers to instruct learners (the ability to properly design and practice instruction). We also clarify the respective roles of teaching practice and university education in teacher education programs, as well as the relationship between them. Then, we propose the use of an instructional design support system called FIMA-Light (Kasai, Nagano & Mizoguchi, 2011) which we have built to support teacher education at university. FIMA-Light can reason about teachers' deep-level intentions from lesson plans designed by them and can automatically produce the entire lesson structure in the form of I_L event decomposition trees. In this paper, we report the results of an experimental practical use of FIMA-Light in a university lecture in a teacher training course.

2. Instruction in University Education and the I_L event decomposition tree

In this subsection, we consider the concrete roles of university education and teaching practice, as well as effective alignment between them in teacher education programs. In their policies, universities (faculties) generally describe this alignment in terms of "Bridging Theory and Practice". Here, as this "Theory", we clarify what trainee teachers should learn in their university education before their teaching practices. To instruct learners effectively, various kinds of knowledge related to learning (for example, knowledge about the mechanisms and processes involved in human learning and knowledge about instructional design methods in order to let students attain an educational goal) is necessary. This knowledge consists of rules that have been formulated by our predecessors through practical experience, investigation, and analysis. These rules have been constructed in the form of various theories, such as learning/instructional theories and Instructional Design (ID) theories. Since these theories cannot be applied to every student and situation, (trainee) teachers cannot always utilize them effectively in their practices. Nevertheless, we think it is important for trainee teachers to learn about these theories before their teaching practices. And they should re-construct these theories in the form of practical knowledge through applying them to concrete situations in their teaching practices. So, in university education, they should aim to achieve the following two main goals before their teaching practices:

- To understand that there are various strategies (flows of instruction and learning) for students to attain educational goals.
  - To understand learning/instructional theories and expert teachers' knowledge gained from practice.
- To improve their skills in designing lessons that integrate a global strategy for attaining an overall goal in the whole lesson and local strategies for attaining sub-goals.

When the alignment with teaching practice is also taken into consideration, the way in which these goals are expressed in the trainee teachers' university education is important. We considered that the I_L event decomposition tree, which is defined based on the OMNIBUS ontology (Hayashi, Bourdeau, & Mizoguchi, 2009), might be suitable for such university education. A method for realizing the state change (macro I_L event) is expressed by a decomposition relation with multiple micro I_L events, called a WAY. In the OMNIBUS ontology, every piece of knowledge extracted from learning/instructional theories and practices can be described as a WAY. The flow of a lesson is modeled as a tree structure of I_L events that is called an I_L event decomposition tree. It is possible for university students to be made aware of the alignment between university education and teaching practice, because the I_L event decomposition tree can express concrete teacher behaviors in interacting with students and concrete teaching materials by repeated decomposition.

The purpose of this study is to provide a system that supports the university education in teacher education programs by using I_L event decomposition trees. One of problems that will be faced in using I_L event decomposition trees for the university education is the difficulty of expression. In order to support the university education, we propose the use of a system called "FIMA-Light" (Kasai, Nagano and Mizoguchi, 2011) which automatically produces I_L event decomposition trees from lesson plans.

3. Trial Use of FIMA-Light in Teacher Education at University

We report on the trial use of FIMA-Light in a lecture (seven students attended) for teacher education, conducted in order to investigate the usability of information that I_L event decomposition trees express. The purpose of this investigation was to find answers to the following question:

- Can I_L event decomposition trees improve university students' awareness of strategies from global to local viewpoints, whose aim is to let school students attain the educational goals?

We think that the result obtained by answering this question can serve as an indicator that shows whether the expression of the I_L event decomposition tree is effective in trainee teachers' university education. The investigation was conducted via the following steps.

1. The instructor (the first author of this paper) explained the I_L event decomposition tree.
2. The instructor directed the university students to create lesson plans and describe what teachers should consider in each scene of the lessons to attain the overall goal of the whole lesson or sub-goals, if they noticed something.
3. The instructor inputted all data of the lesson plans into FIMA-Light and provided the university students with the I_L event decomposition trees that FIMA-Light produced.
4. The instructor let the university students improve their lesson plans.
5. The university students gave a score between one and five (with one being the lowest and five being the highest) in response to the question, "Did you think that your awareness of strategies from global to local viewpoints, whose aim was to let students attain the educational goals, was enhanced by the I_L event decomposition tree?".

First, we show the results of analysis of the number of descriptions of what teachers should consider in attaining the overall goal of the whole lesson or sub-goals. Although the instructor directed the university students, there were on average only 0.86 descriptions in each lesson plan before they improved their lesson plans. This result shows that, at first, the university students were hardly aware of strategies from global to local viewpoints whose aim was to let school students attain the educational goals. After they improved the lesson plans, there were on average 2.29 such descriptions in each lesson plan. The number of descriptions in the improved lesson plans is not enough either, because all scenes in a lesson should contribute to attaining the educational goal of the whole lesson or the sub-goals. However, from the results of the questionnaire (university students gave an average score of 4.43), we judged that I_L event decomposition trees could improve their awareness of strategies from global to local viewpoints whose aim was to let students attain the educational goals.

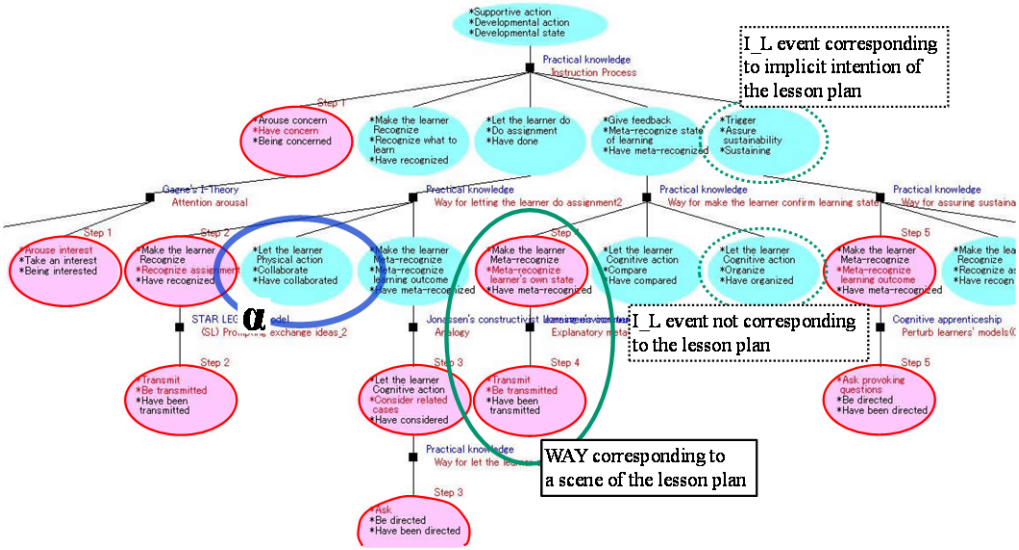

Figure 1. An example of an I_L event decomposition tree and its structure.

Secondly, we introduce an example of such improvements. Figure 1 shows an I_L event decomposition tree that FIMA-Light actually produced from a lesson plan in the investigation. The educational goal of the lesson was that students should understand "suitable behavior in compliance with protection of personal information". In the original lesson plan before it was improved, there was a flow containing two scenes, "the teacher gives students actual cases where damage occurred" and "the teacher asks students about their ideas", in order to let them think about suitable behavior. In the I_L event decomposition tree that FIMA-Light produced from the lesson plan, there was an I_L event ("a" in Figure 1) aimed at letting students "collaborate" between the two above scenes. When the university student was provided with the tree, he added the new scene "discuss in a group" to the lesson plan. He also added the description "do not make a group formed of close students, in order to enhance students' ability to collaborate" to the newly added scene. We focus on the fact that the educational goal "enhance the ability to collaborate", which was not contained in the original lesson plan, was newly added. This suggests that, thanks to the I_L event decomposition tree, the university student could notice implicitly that, even though the educational goal is the same, a difference between ways of attaining that goal results in a difference in the quality and effectiveness of learning. Awareness of such differences is important for teachers to design suitable instructions according to changes in the concept of scholastic ability. The results suggest the possibility that using I_L event decomposition trees in university education can contribute to enhancing the quality of teacher education programs.

In future work, we intend to clarify how FIMA-Light should be utilized in university education in order to let university students efficiently attain the educational goals for teacher education. In particular, we intend to examine the generation of suitable feedback based on I_L event decomposition trees produced by FIMA-Light.

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