

## USING CONCEPT MAPPING TO CONSTRUCT NEW KNOWLEDGE WHILE ANALYZING RESEARCH DATA: THE CASE OF THE GROUNDED THEORY METHOD

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**Abstract.** The paper exemplifies the use of concept mapping during the analysis of qualitative research data, and demonstrates the advantage of concept mapping to derive a grounded theory by highlighting the macrostructure of the research data. Concept mapping serves here to construct new knowledge within the framework of research data analysis and it functions as a model map, in which the map represents existing information and enables the emergence of new understandings and models.

### 1 Introduction

Concept map is a diagram showing interrelationships among concepts (Novak, 1995). It can make the macrostructure of information more salient, by providing a spatial representation of a body of knowledge. Within education, the literature lists three main uses of concept maps: to support learning (including its assessment), to guide teaching (planning educational content and as an instructional tool), and to organize and present information (Cañas et al. 2003). In many different studies concept mapping has been found to support and promote the exploration of concepts, thinking processes, problem solving, information recall, peer discussion, learning transfer, motivation, and more (see, for example, Nesbit & Adesope, 2005; Novak, 1998; O'Donnell, Dansereau & Hall, 2002). Can concept mapping function also as an aid to analyze qualitative research data, specifically within the grounded theory method?

Grounded theory is a qualitative research method that uses a systematic set of procedures to develop an inductively derived grounded theory about a phenomenon (Strauss & Corbin, 1990). This inductive approach follows three stages for coding and analyzing research data. The stages move from the specific to the more general: identifying key elements of the phenomenon, using an open coding (stage 1), grouping the elements into categories and identifying the interrelations among them, using an axial coding (stage 2), and creating the propositions to offer an explanation (the emergent theory) of a phenomenon, using a selective coding (stage 3).

### 2 Purpose

The following paper exemplifies the use of concept mapping during the analysis of qualitative research data, and demonstrates the advantage of concept mapping to derive a grounded theory by highlighting the macrostructure of the research data.

### 3 Study Context

The original study was a self-study on the use of "think-alouds" in teacher education, conducted by the first author. Pinnegar defines self-study as "a methodology for studying professional practice settings" (Pinnegar, 1998, p. 31). Studying teacher education practices via self study is geared towards developing a better understanding of particular pedagogical situations. Self-study methodology has "used various qualitative methodologies and has focused on a wide range of substantive issues" (Zeichner & Noffke, 2001, p. 305). Being teacher educators and researchers, we examined in this study the use of think-alouds (during class and in an electronic blog's posts), and also examined their contribution to the learning of the student-teachers (The self-study on the use of think-alouds by teacher educators was conducted in collaboration with Tom Russell from Queens University, Canada and Amenda Berry from Monash University, Australia).

Think-aloud is a meta-cognitive strategy in which a person thinks explicitly about his thinking processes. Teacher educators use think-alouds to assist their student-teachers to understand how teaching and learning interact by overtly presenting aspects of their pedagogical decision making and putting these forward for discussion, analysis and criticism (Loughran, 2006). In the current study, we examined the use of think-alouds and their contributions to the learning of student-teachers, who participated in a course on learning disabilities taught by the first author during the school year of 2007-8.

## 4 Procedure

We collected protocols of the think-alouds done by the first author in her class, using audio-recording. The think-alouds and her reflections about them were re-written as electronic posts and were published in a "think-aloud blog" that she opened on the internet ([www.takaye.blogspot.com](http://www.takaye.blogspot.com)). Her student-teachers were invited to enter the blog site and add their comments to each of the teacher educator's posts. Their comments reflected their thoughts, feelings and insights regarding the issues the teacher educator raised in her posts, the value of the think-aloud to their learning to teach, and whether they used, or consider using think-alouds in their practice, when and how. One of the posts, and the students' comments to it, served as the basis for the data analysis in the current paper:

On March 25, 2008 the electronic post on the "think-aloud blog" was titled "between rigid planning and flexible response" and it dealt with the tension between planning and being responsive in a teaching situation. Berry (2007) describes this tension as emerging "... from difficulties associated with implementing a predetermined curriculum and responding to learning opportunities that arise within the context of practice" (p. 120). In this post the first author described a class event in which her teaching plan for the lesson was found to be inadequate (many of the students did not bring with them their textbooks, on which class discussion was planned to follow). Although some class murmurs were evident, the teacher educator kept reading out loud the text as the basis for a further class discussion. In her post she described the event, detailed her considerations to follow the original lesson plan and ended with the following reflection and question: "In my think-aloud in class I brought up my thoughts and my considerations to follow the original lesson plan and not to change it. I was also aware of the contradiction between my planning and my inflexible response. I think that I should have been more responsive to what was happening in class and make on-the-spot changes to my lesson plan. As new teachers would you consider involving your pupils in your considerations to change (or not to change) a lesson plan? Which difficulties do you expect to encounter using such think-aloud in class?"

## 5 Data analysis

To qualitatively analyze students' comments to the above post, we chose to use concept mapping. Eight student-teachers commented to the post, and the analysis of their comments facilitated our understanding of their perceptions regarding think-aloud as a teaching method. Each step in the qualitative analysis procedure followed the coding stages for analyzing research data using grounded theory method (Strauss & Corbin, 1990):

**Stage 1 - Identifying key elements:** We identified the key elements in each student-teacher's comment, using an open coding. For example, in Comment 1 we identified the following eight elements: (1) Readiness to use TA (think-aloud), (2) TA may allow more attention to the pupils' reactions and suggestions, such as getting feedback from pupils regarding instruction; (3) TA may increase collaboration with pupils, which can improve them as pupils and people (4) TA may increase the pupils' activeness, attention, and responsibility (5) Expressing increased willingness to use TA in class (6) Not sure about introducing TA in the teaching practicum: should or should not, as (7) The teaching occurs under the supervision of another teacher, and in her home class (8) Should consult the mentor- teacher if considers using TA in the practicum. (See Table 1 for the translation of the Comment into English. It was originally written in Hebrew).

**Stage 2 - Grouping into categories and identifying interrelations:** We grouped the elements in each comment into categories, and identified the interrelations among the categories, by drawing a concept map. The following concept map was drawn for Comment 1 (Figure 1). The starting element in the map was element 1, which was supported by reasons in elements 2, 3, & 4. Element 1 led to element 5, following the explication in the comment, and so forth. All the interrelations are explicit in the comment, except the relationship between elements 5 and 6, which we inferred. Also, the categories (a) and (b) were inferred. The following map indicates the inclusion of each element using the numbered key elements.

The comment was written by a student teacher in response to a post about the tension between planning and being responsive in a teaching situation. The post was part of a teaching blog published during the school year of 2007-8, in the internet ([www.takave.blogspot.com](http://www.takave.blogspot.com)). The following comment was written in Hebrew and was translated into English

"In response to your question, I will be glad to use think-aloud about aspects of planning the lesson. Why? Because I would like to listen to the reactions and suggestions of my pupils, so I could internalize what they had to say and listen to their suggestions. I think that by doing so I can achieve two purposes:

1. A feedback from my pupils about my instructional method, which can be always beneficial
2. I grant them responsibility for their learning. When I give them the power to speak up and to suggest, they become responsible for what happens next.

My thinking (the internal one this time) about it increases my will to try it in class: to think-aloud in front of my pupils about the instructional method and then to apply some of their suggestions and to check in the following lesson whether the power granted to them regarding which instruction to use would actually improve their activeness and attention in the next lesson.

My hypothesis is: yes. If we, the teachers, cooperate with our pupils regarding the instructional methods via our think-alouds, we will change their status to become responsible and serious partners for their learning. This way we will change them into better pupils and even better persons in the future. Also, these things connect to self advocacy and reciprocal teaching – taking responsibility, giving pupils the power and all that it means.

Now I am left to ask: will I be able to try it in my practicum class, or maybe I cannot add new/innovative teaching methods to a class of another teacher? I will have to consult about it with my mentor-teacher, of course.

In case she will say that I can do it, I will be glad to try it in my next language arts lesson and share with you in the blog the consequences."

Table 1: Comment 1

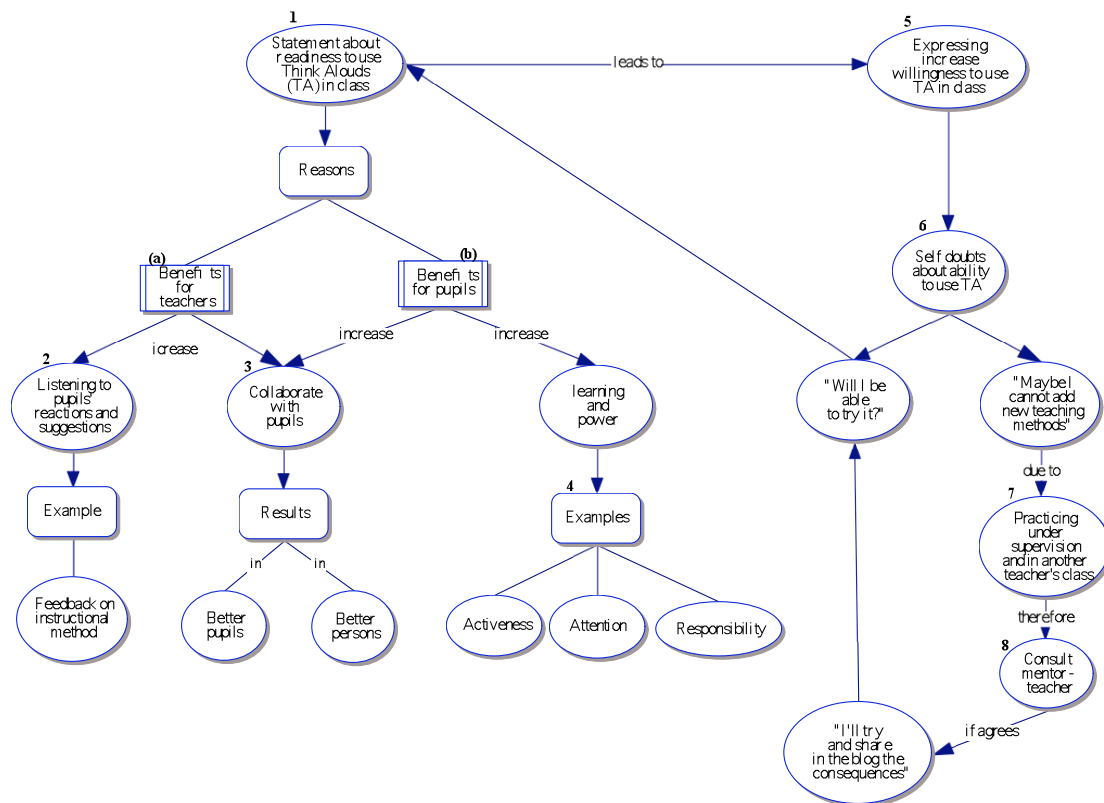


Figure 1: Concept map of comment 1: Using think-aloud in class

To verify the reliability of the procedure we followed stages 1-2 with two independent coders. In stage 1 the first coder identified seven elements and the second coder identified eight elements (of which seven elements overlapped with the first coder), resulting in an agreement of 88%. In a conference we decided to accept the second coder's set of elements. Based on these elements, each of the two coders constructed independently her own map. The first coder's map included 38 objects (nodes + relations), and the second coder's map consisted of 47 objects, resulting in an agreement of 81%. In a conference the two coders accepted the second coder map which is presented in figure 1.

**Stage 3 - Creating the propositions to offer an explanation:** We followed stages 1-2 again, but now the basic "texts" were the concept maps we drew for each of the eight comments. From these maps we extracted a list of four propositions/themes that served to construct of the macro-structure, the grounded-theory map. The propositions were those themes that appeared in several students' comments, and consisted of: (1) TA means to engage pupils in the pedagogical reasoning and decision making of the teacher (2) TA enables changes in student-teachers' attitudes about teaching, such as: (2a) recognizing the complexity of teaching (tensions within the practice, advantages & disadvantages of an instructional method) and (2b) identifying with the teacher's role (teacher is vulnerable and she can make mistakes) (3) Teacher's TA signifies her teaching ownership, which is based on (3a) holding her own classroom, (3b) feeling confident about the lesson plan and (3c) showing competence using teaching strategies (4) The role of the teacher within her teaching context is an important factor influencing the perceived feasibility to enact TA in class: whereas teacher educator (4a) and practicing teachers (4b) are perceived as presenting a sense of teaching ownership, and therefore can practice think alouds in their classes, the student – teacher (4c) is perceived as not holding this sense of teaching ownership and therefore needs to consult the mentor teacher about the possibility of using TA while practicing teaching.

Constructing and linking these themes within a concept map facilitated the emergence of the grounded theory, and assisted in forming an explanation to the studied phenomenon, that is: the use of think-alouds in teaching as an issue of teaching ownership. The following map (Figure 2) illustrates the emergence of a grounded-theory about "teaching ownership".

## 6 Discussion

One of the common uses of concept mapping is to organize and present information for instructional purposes (see Cañas et al. 2003). This paper shows a new use for concept mapping, in which it functions to *construct new knowledge within the framework of research data analysis*. The concept map does not only represent existing information but it also enables the emergence of new understandings and models. Creating a concept map facilitated our ability, as researchers, to internalize the new information; to deepen our understanding of the emerging themes; and it enabled us to look for the interrelations among those themes towards building a model. This process guided us to make inferences, beyond those articulated on the surface. By constructing the stage 3 map, we were able to provide a possible explanation to the phenomenon of using think-alouds by teachers, and that led us to develop an emergent grounded theory about the sense of teaching ownership as a factor in learning and in using new teaching methods, such as think-alouds.

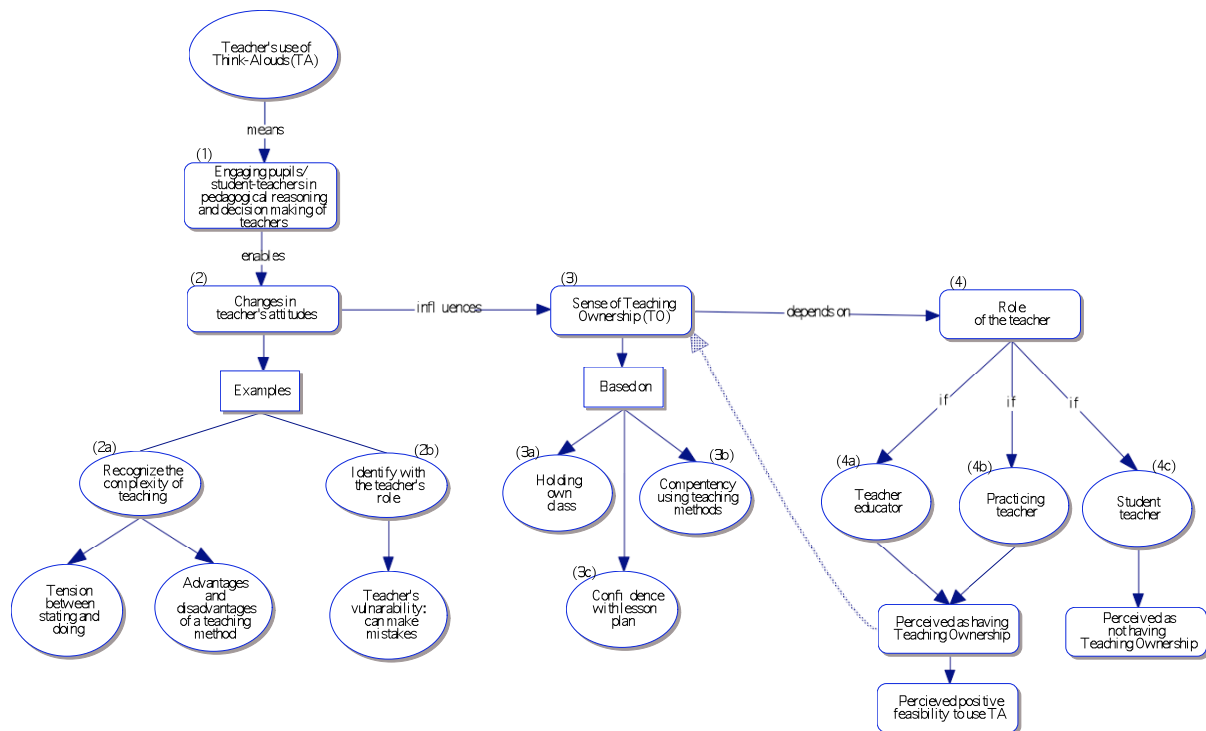


Figure 2. Concept map: The emergent grounded theory about teaching ownership

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