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Differences In Thinking Between Experienced And Novice Teachers When Solving Problematic Pedagogical Situations

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Abstract

Solving problematic situations is an important part of developing teaching expertise in the field of pedagogy for several scholars of teacher education (Bond, Smith, Baker & Hattie, 2000). The current study introduces a test that was developed to explore differences in thinking between experienced and novice teachers when solving problematic situations in the field of pedagogy. Findings showed that more experienced teachers used an action plan to search for information more often, which means that more experienced teachers generally structure their action plans better than novice teachers. The test developed allowed us to distinguish between some characteristics of novice and expert teachers' problem solving. More specifically, experts tended to use an action plan to search for information more frequently.

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Keywords: Teachers' thinking, problem solving

1. Introduction

In the current information age, the development of science and technology gradually boosts the demand for a qualified work force which requires individuals who have reached maturity, pay attention to individual and social development, think, search, make rational decisions and think critically (Yenice, 2011). In line with this, cognition has become an important area of study in several fields of practice. The wider scope of the current research is teacher cognition that guides teachers' professional practices and reveals how they conceptualize teaching. In the field of pedagogy, cognitive readiness and the ability to organize information are very important in dealing with different situations, so learning would take place in a good environment. The latter makes the ability to

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solve problematic pedagogical situations an important skill. Problem solving is generally defined as conscious planning to reach an objective which cannot be reached very quickly; a complicated interaction process of adapting to internal or external needs (Heppner & Krauskopf, 1987; Heppner & Baker, 1997). Solving problematic situations is one of the ten components of J. E. Morrison and J. D. Fletcher's cognitive readiness theory. By cognitive readiness, they mean the mental preparation (including skills, knowledge, abilities, motivations and personal dispositions) an individual needs to establish and sustain competent performance in a complex and unpredictable environment (Fletcher, Morrison, 2002). Critical thinking and problem solving are significant in teachers' work for two reasons: 1) these skills are needed in organizing studies, 2) teaching those skills is one of the main goals of education. This means that teacher thinking is important not only because it influences their personal work outcome, but also because it influences how information is presented to students.

Therefore, one of the most common ideas is to know 'how' individuals think, instead of 'what' they think, and teach that (Yenice, 2011). In the current study, we focus on the differences in novice and expert teachers' thinking when solving problematic situations. Identifying such differences is important because it allows us to point out areas of novice teacher thinking that need extra attention in initial teacher training programs.

Studies of novices and experts (Chi et al., 1981; Larkin et al., 1980) indicate many distinguishing characteristics of their cognitive processes and organizations. Novices tend to present the domain specific problem in a fragmented manner by focusing on fewer concepts or objects referring to surface features in a given situation, which can rather superficially relate to the nature of the problem. Experts pay more attention to the presentation of the problem and planning and provide richer and more integrated cognitive schemas that grasp the nature of the problems. Their vast experience fosters the ability to recognize situation patterns and provide examples of how to react in the recognized situations (Chase & Simon, 1973; Cohen et al., 1998).

Teachers daily deal with ill-defined problems (Simon, 1978) for which terms and outcomes are not fully evident. Effective results could require time consuming analysis of vast amounts of information that is not possible in teaching conditions. Thus, teachers act rationally based on the simplified models of reality they construct (Shavelson, 1983). Expectably, the quality, amount and relevance of such models relates to the development of teacher expertise. Borko & Livingstone (1989: 473) point out that "novices' cognitive schemata are less elaborate, interconnected and accessible than experts' and that their pedagogical reasoning skills are less well-developed."

Based on the theoretical framework outlined above, it is expected that the experienced and novice teachers have a number of differences in thinking. However, since a compact research instrument for investigating experienced and novice teachers' problem solving is lacking, it is difficult to track the development of teacher thinking. In this study, we developed a test to evaluate novice and experienced teachers' problem solving skills and formulated the following research questions: 1) To what extent are the specific experiences related to a problem solving situation related to using different problem solving sub-skills? 2) To what extent can the differences between novice and expert teachers be specified among the sub-skills (characteristics) of problem solving with the test developed? The sub-skills (characteristics) of problem solving (also see Table 1) are determined on the basis of the theoretical framework outlined above.

2. Method

2.1. Sample

The sample consisted of 29 pre-service teachers (n male and n female), who had just completed a school practicum, and 29 experienced teachers (n male and n female). Experienced teachers were selected on the basis of two criteria: 1) teaching experience of at least ten years and 2) teachers who were recognized for their professional work in the school or externally. Participation in the study was voluntary.

2.2. Test

Subjects were asked to solve a problematic situation related to teaching. The test consisted of a description of a pedagogical work-related incident (see below) and guiding questions. The situation was based on a real teaching situation. The test was created by Aivar Ots and Äli Leijen.

In your class (7th grade), there is a girl whose relationship with her fellow students makes you concerned. She came to your school's 6th grade in the spring since she had moved in with her grandmother. At first, the girl did not have adjustment difficulties and seemed to communicate with her classmates normally. The class had 3–4 girls' groups and she did not belong to any of them, rather spending time alone. Among teachers, she was known fairly soon because she was an active and outspoken communicator during lessons. It was believed that she was trying to excel in classroom activities. It was also seen that she was trying to establish contacts with classmates and participate in their activities.

At the end of the last quarter of the previous course, boys in your class were already publicly critical of the girl and the other girls ignored her. The situation disturbed the girl so much that she eventually came to talk to you after lessons. At first, you brought the subject of student relationships up for discussion in the class meeting. You also called the girl's grandmother for whom the girl's concern was a total surprise. After completing these steps, however, it seemed to you that other students' attitude towards the girl was getting even worse.

This description was accompanied by the following guiding questions that aimed to structure teachers' problem solving:

1. Describe how you would reach a decision? What do you do further in this situation?
2. What stages could your course of action compose of and what do you want to achieve at each stage?
3. Explain why you think these activities would yield the desired result?
4. Have you ever resolved a similar situation?

4.1. If you answered "yes", explain how similar your previous experience is to this case.

2.3. Coding of data and data analysis

Pre-defined analysis categories (expert and novice distinctive features) and the criteria (see Table 1) were developed on the basis of the theoretical framework.

Table 1 Analysis categories, variables, criteria and codes

Analysis categories	Variables	Criteria	Codes
Planning activities in accordance with the goals	Setting goals	Occurrence of a goal	If occurred, coded as 1; if not, coded as 0
Defining the situation based on new and old information	Defining the situation through abstract knowledge	Setting the goal through the description of the situation	If occurred, coded as 1; if not, coded as 0
Searching for information	Searching for information	Mentioning the lack of information or searching for it	If occurred, coded as 1...N; if not, coded as 0
Searching for information	Preparing a scheme while searching for information	Existence of a plan to get the information	If occurred, coded as 1; if not, coded as 0
Finding a greater number of solutions and actions than usual	Presenting alternatives while searching for information	Presenting alternatives to get the information	If occurred, coded as 1; if not, coded as 0
Integrating the knowledge	Information is integrated	Elements are associated within the whole case	If occurred, coded as 1; if not, coded as 0
Integrating the knowledge	Knowledge-based abstract principle	Presenting an abstract knowledge-based principle	If occurred, coded as 1; if not, coded as 0
Finding a greater number of solutions and actions than usual	Proposing activities	Intervention expressed with behavior, involving someone or offering activities	If occurred, coded as 1...N; if not, coded as 0
Finding a greater number of solutions and actions than usual	Outlining conditions for activities	Criteria for the activities	If occurred, coded as 1...N; if not, coded as 0
Finding a greater number of solutions and actions than usual	Presence of an action plan	Presenting stages of an action plan	If occurred, coded as 1...N; if not, coded as 0
Finding a greater number of solutions and actions than usual	Presenting alternatives to actions	Presenting alternatives to actions and action plans	If occurred, coded as 1...N; if not, coded as 0
Greater experience	Personal experience related to the situation	Mentioning of personal experience	If occurred, coded as 1; if not, coded as 0
Greater experience	Re-occurrence of related experience	Mentioning of personal experience and using it in the solution	If occurred, coded as 1; if not, coded as 0

Notes: Situation assessment-related variables are given in italics and action/intervention-related variables in bold.

Table 1 shows that the variables are divided into two parts:

1. Variables related to assessing a situation: setting goals, defining the situation through abstract knowledge, searching for information, preparing a scheme while searching for information, presenting alternatives while searching for information, integrating information, a knowledge-based abstract principle;
2. Variables related to action/intervention: proposing activities, outlining conditions for activities, the presence of an action plan, alternatives to actions, personal experience related to the situation, re-occurrence of related experience.

Chi-square tests and Configural Frequency Analysis (CFA) were used to explore the relationships between the variables of problem solving. The Chi-square test was used to evaluate pairs of variables. Configural Frequency Analysis (CFA) was used to explore the relationships between multiple variables. CFA is an extension of the Chi-square analysis, which identifies in cross-tabulation of categorical variables whether the patterns of included characteristics appear more frequently (i.e., a type appears) or less frequently (i.e., an antitype appears) than would be expected by chance (von Eye, 1990). CFA was an individual-level analysis, in which individual properties of cases were preserved without any group-level generalization; the CFA module EXACON in the Sleipner statistical program package (Bergmann & El-Khouri, 2002) was used for the analysis.

3. Results

Firstly, we investigated whether actual experiences related to the pedagogical situation were related to how teachers solved the task. Personal experience was indicated by 6.9% of novice teachers and 17.2% of experienced teachers. Chi-square analysis showed that the teachers who had experienced this situation before 1) were looking for information more often while preparing the action plan ($\chi2 = 14.59$, df = 1, p <.001) and 2) prepared more action plans ($\chi2 = 19.95$, df = 1, p <.001). This indicated that experiences with specific situations are related to some characteristics of problem solving while analyzing this problematic situation.

Secondly, we performed CFA to compare certain problem solving characteristics (see Table 2) between pre-service teachers and experienced teachers.

Table 2 Configural Frequency Analysis results with variables: seeking information, preparing a scheme while searching for information and presenting alternatives while searching for information

		Found combinations of variables				
		000	100	101	110	111
Novice teachers	Observed frequency	3	**22**	3	*1*	0
	Expected frequency	2,0	**16,0**	2,5	*7,0*	1,5
	P-value	p<.32	**p<.05**	p<.45	*p<.00*	p<.21
Experienced teachers	Observed frequency	1	**10**	2	**13**	3
	Expected frequency	2,0	**16,0**	2,5	**7,0**	1,5
	P-value	p<.40	**p<.04**	p<.54	**p<.01**	p<.18
Total		4	32	5	14	3

Notes: Types are presented in bold, antitypes in italics. The found combinations of variables (seeking information, preparing a scheme while searching for information and presenting alternatives while searching for information) are presented from left to right: if the variable occurred, it was coded as 1; if not, it was coded as 0.

The results of CFA indicated one type which showed that novice teachers searched for information (75.8%), but there was no action plan and no alternatives for finding information. With experienced teachers, the same type occurred, but in a smaller proportion of the sample (34.5%), and a slightly higher proportion (44.8%) of them were looking for information and preparing a scheme for finding it. The statistically significant antitype was that novice teachers were not preparing a plan in order to obtain information. This again indicates that, even if novice teachers were looking for information more often than experienced teachers, they did not have a specific plan for collecting the information needed.

Third, the CFA carried out with a second set of problem solving characteristics (see Table 3) that aimed to find out whether experienced teachers have more alternatives to actions while planning indicated two types and one antitype.

Table 3 Configural Frequency Analysis results with variables: presenting an action plan and alternatives to actions

		Found combinations of variables			
		00	01	10	11
Novice teachers	Observed frequency	**21**	3	*4*	1
	Expected frequency	**12,0**	3,0	*10,5*	3,5
	P-value	**p<.00**	p<.64	*p<.01*	p<.12
Experienced teachers	Observed frequency	*3*	3	**17**	6
	Expected frequency	*12,0*	3,0	**10,5**	3,5
	P-value	*p<.00*	p<.64	**p<.02**	p<.13
Total		24	6	21	7

Notes: Types are presented in bold, antitypes in italics. The found combinations of variables (presenting an action plan and alternatives to actions) are presented from left to right: if the variable occurred, it was coded as 1; if not, it was coded as 0.

In case of novice teachers, a type occurred (72.4%) where neither of the variables (presenting an action plan and alternatives to actions) appeared. In addition, we found an antitype where novice teachers (13.8%) had no action plan. Experienced teachers' results were reversed: we found a type among experienced teachers (58.6%) who had a plan and an antitype (10.3%) with no action plan or alternatives to actions. This shows that experienced teachers made more often action plans than novice teachers.

In brief, the results indicate that experienced teachers were looking for information more frequently while making action plans, and they drew up more action plans overall. The distribution of responses shows that the task developed distinguishes respondents slightly. The results suggest that, in general, experienced teachers structure their plans better than novice teachers.

4. Conclusion

The main aim of the study was to investigate how the thinking of more experienced teachers differs from that of novice teachers when dealing with problematic work situations. In order to investigate the possible differences in problem solving skills, a test was developed to investigate problem solving among a group of pre-service and experienced teachers. It turned out that the expected different results between the experienced and novice teachers based on the comparison of the two groups in the theoretical part did not occur in the empirical part of the paper as evidently as they did in the characteristics listed in the theoretical framework. Personal experiences related to the situation were associated with the use of some characteristics of problem solving. The results suggested that more experienced teachers used an action plan to search for information more often, which means that more experienced teachers generally structure their action plans better than novice teachers. Moreover, the results indicated that experienced teachers were searching for information more frequently when making action plans, drew up more action plans overall and structured plans better than novice teachers. In conclusion, the test developed allowed us to distinguish some differences between novice and expert teachers; however, specific experience did not prove to be as important an indicator of differences as expected. In future, stricter criteria could be developed for choosing expert teachers. In addition, next to the structure of the solutions, the content of the solutions should be analyzed in relation to the structure.

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