

# An Investigation of Experienced and Inexperienced Primary School Teachers' Teaching Process in Science and Technology Classes in Terms of Metacognitive Strategies

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## Abstract

This comparative case study aimed to investigate whether experienced elementary school teachers' science and technology teaching processes differed from inexperienced teachers' teaching processes in terms of using metacognitive strategies. 14 elementary school teachers, including 7 experienced and 7 inexperienced- participated in the study. The qualitative data were collected through unstructured observation and semi-structured interview in 90 class hours in total. The data were analyzed through content analysis. The results show that experienced elementary school teachers perform more activities related to metacognition before, during and after science and technology teaching process and they make use of more metacognitive strategies addressing many components of metacognition such as planning, observation, and organization. These findings revealed that teachers should be trained in in-service programs in a way that they would implement metacognitive strategies into their classes and their skills about metacognitive strategies implementation should be reinforced.

## Key Words

Metacognition, Science and Technology Education, Differences between Experienced and Inexperienced Teachers, Teacher Training.

How novice teachers become experienced teachers has been one of the main concerns of teacher training (Byra & Sherman 1991; Fogarty, Wang, & Creek 1983; Schempp, Tan, Manross, & Fincher, 1998). Intensive and developed professional background of experienced teachers help them to reach high performance level easily and effortlessly (Schempp et al., 1998). The studies conducted with experienced and novice teachers also aim at understanding the nature of becoming experienced. Many

studies have been carried out with experienced and inexperienced teachers in order to see from what perspectives there are some differences between these two groups of teachers (Artzt & Armour-Thomas, 2001; Borko & Livingston, 1989; Byra & Sherman 1991; Fernandez & Ritchie, 1992; Freitas, Jimenez, & Mellado, 2004; Fogarty et al, 1983; Ge & Hardre, 2010; Henry, 1994; Klimczak, Balli, & Wedman, 1995; Rahilly & Saroyan, 1997; Schempp et al, 1998; Westerman, 1991). In these studies, teachers' pedagogical and professional background, their beliefs and attitudes about teaching, and their teaching processes have been taken into consideration in terms of various aspects. Factors influencing becoming experienced have been investigated.

Although there are different point of views on becoming experienced, the most traditional perspective is on the accumulation of experience and

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knowledge (Berliner, 1986 cited in Klimczak et al., 1995; Ge & Hardre, 2010). However; a group of researchers claims that only practice is not enough in becoming experienced (Sternberg, 1996; Winner, 1996 cited in Ge & Hardre, 2010). They further say that experienced and inexperienced teachers should be analyzed in terms of motivation, cognitive structure, personal point of views, and metacognition (Ge & Hadre, 2010).

There is a great number of studies abroad conducted with experienced and inexperienced teachers. In Turkey, the research based on experienced and inexperienced teachers has mainly been about classroom management, decision making process and writing assessment (Duranhoğlu, 2004; Nakiboğlu, 2009; Soltay, 2007; Şahin, 2004; Şire, 2004; Unat, 1999; Yılmaz, 2004). Also, the number of these studies is quite limited. Within the limits of accessible materials, it has been seen that experienced and inexperienced teachers' teaching process have not been investigated in terms of metacognitive strategies.

Metacognition is one of the main variables affecting learning and teaching through metacognitive strategies reinforces learning (Carry & Reder, 2002; Gourgey, 2001; Kuhn, 2000; Sabers, Cushing, & Berliner, 1991; Schraw, 2001; Schraw, Crippen, & Hartley, 2006; Schraw & Moshman, 1995; Scruggs, Mastropieri, Monson, & Jorgenson, 1985 cited in PP, 2008; Wang, Haertal, & Walberg, 1994). Students differing regarding academic achievement also differ in terms of metacognition (Jegade, Tablin, Fan, Chan, & Yum, 1999; Doğanay & Demir, 2010; Emrahoğlu & Öztürk, 2010; Goos, Galbraith, & Renshaw, 2002; Lucangeli, Coi, & Bosco, 1997; Öztürk, 2009; Romainville, 1994). Metacognition is important and necessary for students at all ages (Hennessey & Beeth, 1993; Manning & Payne, 1996; Martinez, 2006; Marzano et al., 1988). Keeping these in mind, issues about experienced and inexperienced teachers should be analyzed from the perspective of metacognition. Similarities and differences between them should be investigated in order to conduct more effective teacher training and teaching-learning activities. In addition, this study is supposed to contribute to science classes which requires the use of metacognitive skills (Georghades, 2000; Hartman, 2001) as it provides a more detailed information and is beneficial for science and technology classes. Also, this study aims to contribute to international related literature about teacher training and science teaching. In line with these objectives, this study intends to

answer the research question below:

- Do experienced and inexperienced teachers' teaching process in science and technology courses differ from each other in terms of metacognition?

### Method

This is a comparative case study investigating whether experienced teachers' science and technology courses teaching process differ from inexperienced teachers' in terms of using metacognitive strategies (Lightfoot, 1978; McIntyre, 1969 cited in Bogdan & Biklen, 1992). The subjects were chosen according to a type of purposive sampling, namely; criterion sampling. 14 elementary school teachers, including 7 experienced and 7 inexperienced participated in the study. The criterion for the experience has been determined by using literature findings (Freitas, Jimenez, & Mellado, 2004; Korevaar & Bergen, 1992; Martin & Baldwin, 1994; Moallem, 1994; Schempp et al., 1998).

From the inexperienced teachers group, five teachers had an experience period of 2 and 4 months, two teachers had an experience period of 1.5 year. These teachers did not have extra teaching loads except their actual classes. The experienced teachers had an experience period of 20-25 years and they already gave private courses and worked in private schools. For the data collection, unstructured observation was done in 90 class hours and semi-structured Cognitive Awareness Skills Evaluation Forms (CASEF) were used. Content analysis was conducted on the data collected by using explicitly and selectively coding (Strauss ve Corbin, 1990). Reliability and validity studies were done on the data and it was found that coder reliability was 87 % for interviews and 85 % for observations (Miles & Huberman, 1994; Yıldırım & Şimşek, 2006).

### Results

The findings were classified into two as interview results and observation results below. The findings based on observation show that in science and technology courses teaching process experienced and inexperienced teachers plan, question, observe the learning process, organize the learning process, identify and revise conceptual misunderstandings, evaluate and make use of metacognitive strategies addressing operational, feedback and conditional knowledge. Also, it is found out that experienced and inexperienced teachers' teaching

processes differ from each other in terms of using these strategies. Experienced teachers aim at motivating students to participate in classes actively, so they arrange student-centered activities. They tend to develop students' thinking skills and they ask students further questions focusing on students' own thinking processes. In addition, they provide practice opportunities in a way that students can relate what they have learnt into their real life and transfer their knowledge. Experienced teachers observe unwanted behaviours during classes and they follow their students' learning and organize their classes accordingly. Moreover, in order to reveal learning difficulties, they try to identify conceptual misunderstandings, to correct them and to give immediate feedback. They are also seen to make use of metacognitive strategies addressing conditional and operational knowledge effectively and they have a comprehensive understanding of evaluation. On the other hand, inexperienced teachers use a limited number of metacognitive strategies during their science and technology classes teaching process. It is observed that novice teachers mostly prefer lecturing and they plan their classes accordingly. Metacognitive strategies used by experienced teachers are not continuously implemented or are not used at all by novice teachers. Also, it is seen that novice teachers mainly focus on content and they are worried about their time schedule, so they can not observe their students' learning process, and they do not develop any skills to regulate their students' learning. Furthermore, they are not good at giving feedback and at following learning difficulties. Some unwanted behaviours are observed in novice teachers' teaching process. When novice teachers are considered within the group, itself, two more experienced teachers than others in the inexperienced teachers group show similarities with experienced teachers.

When it comes to interview results, it is seen that there are significant differences between experienced and inexperienced teachers' metacognitive attitudes before, during, and after the teaching process. Experienced teachers, when compared to inexperienced teachers, do more detailed preparations, and they tend to organize student-centered classes. However, novice teachers focus on the topic itself and they intend to keep with the time schedule of their academic programmes. On the other hand, both group of teachers mention that they observe and deal with unwanted behaviours. As for the post-teaching activities, it is seen that experienced teachers have a more comprehensive understanding of evaluation than inexperienced teachers.

## Conclusion and Discussion

The research results point out that experienced teachers differ from inexperienced teachers in terms of metacognition. Experienced teachers use metacognitive strategies about teaching more than inexperienced teachers and they are better at observation, organization, and planning. The findings of this study are in line with the results of different studies in the related literature. Artzt and Armour-Thomas (2001) analyzed experienced and inexperienced maths teachers' teaching process regarding metacognition. Their results show that inexperienced teachers mainly focus on their own way and they strictly attach to the content of the target course. Also, they stick to their original lesson plan and they do not revise their plans according to students' learning. Moreover, they make assessment on class time and students' behaviours. Furthermore, it is seen that inexperienced teachers see themselves as distributors of knowledge and they are bad at giving feedback. On the other hand, experienced teachers guide students to make self configuration, so they prefer student-centered classes and they observe their students' learning, evaluate content and their students' learning.

In a study by Artzt and Armour-Thomas, it is found that one of the inexperienced teachers share some similarities with experienced teachers. In this study, it is seen that two of the inexperienced teachers have more similar characteristics with experienced teachers. When these two inexperienced teachers are compared to their counterparts in the group, it is seen that they have 1.5 year experience. However, the other two inexperienced teachers have 2-4 month teaching experience. Therefore, this result is not surprising. In relation to this, Berliner (1988) said that there are five phases in transferring from inexperienced phase into experienced one. He added that being an expert starts with being a novice. Teachers in their first year are in that step. Within one year, they pass through a more advanced phase and they become better at teaching (cited in Schempp et al., 1998). From a different perspective, Artzt and Armour-Thomas mentioned that in their study, some experienced teachers have got some points in common with inexperienced teachers. For example; although these teachers have made a detailed planning in their teaching process, they could not follow the plans because of lack of knowledge. Within the scope of this study, we have not encountered such a finding about experienced teachers. Experience period experienced teachers in Artzt and Armour-Thomas' study ranges

from 7 to 25 years, so this research group is very heterogeneous in terms of experience. Also, these teachers do not show any qualities about becoming an expert, that is; they are only different from their inexperienced counterparts in terms of experience period. However, our study has a very homogenous participant group as participants have an experience period of 20-25 years. Also, the participants in our study have given private courses and have worked in private courses, which requires an accumulation of knowledge and experience of becoming an expert. Therefore; it can be concluded that experienced teachers considerably differ from novice teachers as they are equipped with high expert qualifications as well long experience periods.

When the findings of this study are continued to be considered concerning the findings in the related literature, it is seen that experienced teachers observe the negative things in their teaching process and identify the problems. Then, they change their plans accordingly. However; inexperienced teachers do not take into account the ongoing process in their teaching and they do not evaluate the teaching process. Also, they do not revise their plans. In addition, experienced teachers are systematically seen to make more comprehensive plans and their awareness about organising teaching environment and their pedagogic knowledge are better. In their study with one inexperienced and two experienced teachers, Freitas, et al. (2004) found out that experienced teachers have a less traditional teaching approach when compared to novice teachers and their students are more active in their classes. Also, in their study, experienced teachers are seen to find relationships with daily life and real life problems. Fernandez and Ritchie (1992) conducted a study with six novice teachers who just started teaching. According to their study, inexperienced teachers have difficulties in planning teaching process, giving feedback, and evaluating students' learning. Borko and Livingston (1981) found that experienced teachers spend more time on lesson planning and they can watch out the efficiency of their classes and they can change their teaching approach according to class demands. Lastly, experienced teachers are considerably better at metacognitive skills (cited in O' Connor & Fish, 1998). In relation to this, many researchers in this field say that experienced teachers are better than inexperienced teachers at planning, observing class, identifying problems, decision making according to class objectives, and metacognition (Carter et al., 1987; Gagne, 1985; Gage & Berliner, 1984; Leinhardt & Smith, 1985 cited in Rahilly &

Saroyan, 1997). When the findings of this research and other results in the field are combined, it can be said that metacognition may be influential in gaining experience and becoming expert in science and technology teaching. Here are some suggestions in line with the research findings:

This research points that experienced teachers are different from inexperienced teachers in some components of metacognition such as observation, organization, and planning. Therefore, teachers' awareness about cognition should be developed about in-service teacher training programmes. In addition, both quantitative and qualitative studies should be conducted in order to obtain more comprehensive information about teachers' metacognitive skills. This research carries messages only for teachers. It does not include any information about students' achievements and students' point of views based on the process. Studies covering both students' achievements and their opinions should be carried out. Furthermore, longitudinal studies should be conducted from the first day novice teachers start teaching in order to reveal the main changes in becoming an expert in the field.

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