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MTEACOGNITIVE APPROACH – A PRACTICAL APPROACH FOR TEACHING COMPUTERS

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ABSTRACT

The paper deals with the concept of Meta Cognitive solutions for teaching computer science. Most beginners at school level face many challenges while learning computers. The paper deals with use of metacognitive interventions for dealing with their challenges like awareness and understanding the metacognitive interventions. The paper also includes a qualitative case study of use of metacognitive interventions by computer teachers. The difference which metacognition makes in the classroom environment has been established in the case study. The improvement in the attitude of teachers as well as that of the students for a better teaching and learning environment has been established in the paper. The teaching of computer science can be made more effective by creating awareness and understanding of metacognitive approach among computer teachers and it can make teaching more entertaining also.

Keywords: Metacognitive Interventions, Attitude of Computers, Classroom Environment, Challenges of Teaching Computers

1. INTRODUCTION

The mental capacity to use the ideas and logic common to computer science and computing to solve problems is known as computation thinking (Wing, 2006). The education community also views metacognition as a useful predictor of learning (Veenman, Wilhelm, & Beishuizen, 2004). The best teaching strategies for improving pedagogical practices are those that emphasise students' metacognitive and self-regulated learning (Hattie, 2008). The significance of metacognitive experiences in students' learning has been emphasised in recent decades (Efklides, 2001, 2006). When people actively participate in their own learning process, they might be characterised as self-regulated (Zimmerman, 1989). Volet (1991) defined "metacognitive strategies" as the application of metacognition components to support learning, such as planning, selecting, monitoring, assessing, and revising.

According to Flavell (1979), thinking about thinking or cognition (e.g., memory, reasoning, perception, etc.) is known as metacognition. In teaching and learning, Students are encouraged to assess their own thought processes through programming activities. Applying a recently learned problem to new problem scenarios is made easier by these cognitive exercises (Mayer, 2011). These tactics are among the key elements of classroom self-regulated learning methods (Pintrich, 2004). Research by Richardson et al (2012) demonstrated a positive correlation between academic achievement and the use of such tactics. It is usually the initial step before coding a programme, regardless of the problem-solving techniques employed. In order to solve problems and advance knowledge, trial-and-error is essential (Davidson et al, 1994). Students should be able to intentionally and explicitly connect their learning across settings and between their present and future learning by developing metacognitive methods, especially those aimed at transfer.

Students generally state that learning the skills necessary for computer programming is challenging. Linn and Clancy (1992) identified the two main issues with computer learning as analytical abilities and problem-solving skills. Ismail et al. (2010 argued that many pupils are "woefully inadequate" in their ability to solve problems. According to Soloway and Spohere (2013), students' primary areas of weakness in computer science are their analytical thinking and problem-solving skills, and computer science programmes should prioritise these abilities. The cognitive abilities needed to solve problems in computer programming classes necessitate that students work methodically and construct representations, which fosters an atmosphere that is conducive to the growth of metacognition abilities and awareness. The ability to apply knowledge and skills learned from several fields to unimagined challenges in new contexts may be necessary in and for the future economy. Students' performance, reading, and problem-solving skills have all been demonstrated to benefit from metacognitive training and instruction (Zohar & Barzilai, 2013). Indeed, the most successful methods for improving instructional practices are those that emphasise students' metacognitive and self-regulated learning (Hattie, 2008). This research will therefore investigate the potential benefits of metacognition for students' learning.

2. CHALLENGES FACED BY INEXPERIENCED COMPUTER STUDENTS

As a computer science student, you may face a number of challenges that can seem daunting at times. The most common ones are staying motivated, staying updated, time management, learning new skills, collaborating with others and staying up-to-date with industry trends. Metacognition plays a crucial part in computer programming problem-solving. In contrast to pupils who perform poorly in programming, Bergin et al (2005) discovered that students who had metacognitive management skills and techniques perform exceptionally well. Havenga et al (2013) reaffirmed that the more complicated a computing challenge is, the greater the necessity for metacognitive control, purposeful reflection, and positive feed- back.

3. LEARNING COMPUTERS BY BEGINNERS

Computing at higher level is extremely difficult to learn. The researches have made numerous attempts to pinpoint the characteristics of beginners and their learning attitudes. The progression of the beginner to a higher level can be characterised as the teaching learning process. Regarding the distinctions between beginners and high performers, the former struggle with logical abilities, but the latter possess effective conceptions or a virtual mental model in the context of higher skills.

4. WAYS TO IMPROVE BEGINNERS' COMPUTER EFFICACY

PROMOTING METACOGNITIVE AWARENESS

Several proponents of metacognition offer methods and approaches to encourage students' metacognition. Some of them offer general methods and while others offer more focused strategies. Comparatively speaking, students are more adept than teachers at modelling cognitive and metacognitive abilities and offering compelling justifications. Teachers should spend some time talking about the value of metacognitive knowledge and regulation, as well as how it is specific to self-regulated learning (Schon, 1987). Second, educators should work hard to support their students' metacognition by modelling it for them. For promoting metacognitive awareness, the teacher should set aside time for group discussions and introspection (Rogoff, 1990).

INCREASING UNDERSTANDING OF COGNITION

The various studies indicate that the teaching and learning system should concentrate on improving the methodology and strategy of choosing educational content, methods, and organisational forms of training, creating a system for students' activeness, forming their independent computing skills, and providing consistent evaluation of their knowledge; ensuring the regularity of students' educational work; and increasing their capacity to work independently with a variety of information sources (Umirzakovna, 2019). According to Derry (1990), learning fundamental curriculum knowledge in a way that is relevant and meaningful for future problem-solving is necessary for the development of general thinking skills and higher-order thinking.

CREATING FAVOURABLE CLASSROOM CONDITIONS

The students may be equipped with the essential metacognitive skills and knowledge but may not apply them at all or effectively. Students may not credit these abilities and knowledge for their success even if they do use them. According to Schraw (1998), one strategy to create an environment that is conducive to enhancing metacognition for learning in the classroom is to support students in mastering goal orientation, which focuses on raising students' performance levels and rewarding greater effort and persistence. Hofer and Pintrich (1997) highlighted the link between students' or learners' beliefs and motivation. When students believe their chances of success are slim, they may not be motivated to put in the extra work.

5. USING METACOGNITION IN COMPUTER TEACHING

To explore the metacognitive implementation and metacognition awareness in computer courses, the authors of this paper conducted interviews of experienced computer teachers of a technical college. Each interview was for almost half an hour. The teachers were explained the academic need of the study to encourage them to volunteer their participation. Every interview session was carried out individually for each teacher. The following questions were taken from a study by Rum and Zolkepli (2018) and were used after rephrasing keeping in mind local teaching environment.

1. Are you familiar with the concept of metacognition?
2. Could you explain the concept of metacognition? (After reading the definition.)
3. Do you think that metacognition is important in computer science education?
4. What was your experience while applying metacognitive skills in your class?
5. How metacognitive interventions helped you as a teacher?

6. PARTICIPANTS OF THE STUDY

For the interviews, five teachers designated as T1, T2, T3, T4 and T5 with minimum 10 years of experience were chosen. All of the participants had experience of teaching a variety of computer subjects.

7. FINDINGS

ABOUT FAMILIARITY OF CONCEPT OF METACOGNITION

All of the teachers were questioned about their familiarity with the word "metacognition" at the start of the interview. In response, two of the teachers said they have heard about *concept of Metacognition* but are not exactly aware where three were totally unfamiliar with the concept.

Eventually, they were explained the meaning of meta-cognition in the group.

EXPLANATION OF THE CONCEPT OF METACOGNITION AFTER LEARNING THE MEANING

They were asked to explain the concept by indicating a few words of the definition of metacognition. T1 stated that metacognition is “teaching with probing aids like pictures”. T2 and T3 were almost identical in their explanation and referred it as “applied teaching method”. T3 was straight in her explanation that metacognition is “making students think”. T4 and T5 said that metacognition is "making students find more information to apply their knowledge"

The exercise was enough to conclude that the teachers need training to understand and apply metacognition for teaching computers.

IMPORTANCE OF METACOGNITION FOR A COMPUTER INSTRUCTOR

When asked how crucial is for computer teachers to understand metacognition, the teachers responded that metacognitive teaching can help them to be ‘prepared’ (T1), analytical (T2), practice-oriented (T3), ‘using labs effectively” (T4) and ‘changing students’ aims of doing a computer course’ (T5).

The teachers were now more precise in their understanding the need to adopt metacognition in their teaching efforts.

Subsequently, the teachers were asked to deliver a session to students keeping in mind the metacognition. They were asked about their experiences.

APPLICATION OF METACOGNITION IN COMPUTER PROGRAMMING INSTRUCTION.

T1 said that she was more conscious in 'understanding students' active participation' in the class. T2 said that she 'planned and prepared thoroughly before teaching' for giving more practical examples to 'provoke their thoughts'. T2 focused on "interacting with students by discussing more". T3 assured herself of "thinking of the concept more than ever before resulting in teaching inquisitively and thinking with students,". T4 was more candid and said "teaching with problem-solving approach". T5 explained that she was "discussing and learning more from the students as their participation had increased"

HOW METACOGNITIVE INTERVENTIONS HELPED YOU AS A TEACHER

Almost all teachers were synonymous in their responses, though explained differently. They found teaching 'more entertaining' for self as well as for the students. They concluded that the students were more actively engaged in the class and that encouraged them to prepare better for their next class. One teacher quipped, "there was nothing like a back bencher type student in the class'. They said that new method helped them to evaluate the strength and weakness of their own teaching. Everyone was of the common opinion that the students were more interested in remaining in the classroom for question-and-answer session for 15 or 30 minutes at the end of the class session.

8. CONCLUSION

The Metacognitive approach can help students and teachers in more engaging learning process. By promoting metacognitive awareness, increasing students and that of teachers understanding of cognition and creating favourable classroom conditions, the teaching learning process can be made more effective. The metacognitive approach is highly relevant for teaching of computers. Metacognitive awareness, knowledge, and techniques have been exercised throughout the teaching and learning activities, which allow students opportunities to develop their capacity to transfer the knowledge and provide understanding regarding how to extend their abilities. Both the teachers and students will be able to recognize their own abilities if they understand and apply metacognition. If teachers are able to incorporate metacognitive strategies into their teaching and learning activities, they may be able to develop an effective plan for students to enhance their learning.

CONFLICT OF INTERESTS

None.

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