

Effect of Motivational Strategies on Science Students’ Cognitive Engagement

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Abstract

One of the major problems faced by teacher is that students are not motivated to learn and fail to do class participation. To maintain motivation and tying students’ Cognitive Engagement, individual motivation can be influenced with the help of different motivational strategies. This experimental study (pre-test posttest control group design) was conducted in a public school of Punjab province at elementary level. During experimental study five different motivational strategies (worksheets, puzzles and hands-on activities, encouragement, rewards & punishment) were used to cover the content from the 7th class general science book for a period of 2 months. After the intervention, results of t-test revealed that the strategies used in experimental group engaged students’cognitively and are capable of doing their work with enthusiasm, commitment and keen interest and trying to command mastery over their learning to achieve the highest result; whereas “disengaged students” do their work but without commitment and interest. It was recommended that different types of motivational strategies be introduced in the curriculum of PTTB at primary and elementary level to completely engage the students.

Key words: Motivational strategies, Student Cognitive Engagement, Science

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Introduction

In the global scenario, one of the issues of 21st century is the engagement of the learner in a meaningful way and in schools engagement is considered as an important construct for students' success which related to multiple educational outcomes (Saeed, 2012). Several studies have documented that students' classroom engagement is recognized as a primary variable which is gradually operate in students' life and is a vigorous predictor of their achievements (Appleton, Christenson, & Furlong, 2012). In the process of education process, the degree of curiosity, concentration, awareness, passion and hopefulness refers to the students' engagement to show when they are in learning or being taught, and extends to the level of motivation and try to achieve progress during their education. Literally, students are curious about paying attention or optimistic when their learning improves and that learning tends to suffer when students are jaded and pessimistic, or else "disengaged (Daggett, 2005). According to academicians, students' engagement or enhanced student cognitive engagement is most desirable objective of teaching and concept of cognitive engagement has attracted growing interest among researchers as a way to improve low levels of academic achievement, high levels of student boredom and dissatisfaction, and high dropout rates in urban areas (NRC;2004). Cognitive Engagement defined as how the student tries to learn strategically in terms of elaboration rather than memorization and how a student can comprehend difficult ideas and gain mastery over learning (Walker et al, Greene, & Mansell, 2006). The concept of cognitive engagement can be elaborated into three different types like skills, mastery and mental effort (Christenson et al., 2012; Fredricks, Blumenfeld, & Paris, 2004). Basically, these concepts of students' cognitive engagement construct and overlap with each other regarding conduct, attitudes, self regulated learning and mastery (Zeidner, 2014; Zimmerman, 1990) and are complimentary for each other to measure how students think in a meaningful way. The term cognitive engagement is valuable under the combination of skills, mental effort and mastery over learning to provide an affluent characterization of children to examine these indicators separately in a single construct and can be stable via short or long terms pattern and can vary in qualitative differences with duration and intensity. According to Dawson (2000) during activity based learning, the children showed more interest and interest in different areas of science varies with different motivational strategies side by side with combination of cognitive engagement (Educacao, et al 2012). Moreover, Roorda, et al (2013) said that students are fully engaged by a teacher who is capable of knowing how to achieve higher academic success by increasing cognitive engagement in students.

One of the major problems faced by teachers is that students are not motivated to learn and fail to participate in classroom, maintains motivation and tying students' Cognitive Engagement, individual motivation can be influenced with the help of different strategies Maheshwari, (2010) stated that motivated children are more easily engaged as compared

to unmotivated children if their aim is to learn; hence, they show keen interest and attention and are readily engaged cognitively. On the other hand, unmotivated children are considered difficult to engage cognitively when they are passive and bored, especially those who are struggling with educational needs and have their poor attitude towards learning which aggravates their problem. Which give raise a challenge for the teachers to help disengaged students to meet the required educational goals.

Upgrading of an online education resource “Learning for life, not for grades” is the eye catching caption (Evans, 2014), which describe that majority of schools restricts children to regular tests, eliminate interest and engagement in replace rather instill fear of failure among students. It means students do not acquire the proper learning and they just learn to get passing marks from tests while, to maintain motivation in students and enhance interest in learning is a major challenge for teachers (Cole, Mahar & Vindurampulle,2010).On the other hand, through different motivational strategies students can be fully engaged by a teacher to achieve academic success (McLeod & Allen-Craig,2007; Martin & Fleming, 2010; Neill, 2008).Curiosity, attention &engagement in learning can be maintained by motivational strategies used by teachers in the classroom environment (Blum, 2015;Cavanagh &Kennish, 2009; Gibbs & Poskitt,2012; Edwards &Zyngier, 2014). Researchers found that the key factor to determine student success and influence them effectively learning by motivational strategies in the classroom (Banya& Cheng, 1997; Dornyei, 1994; Fives & Manning, 2005). Those strategies which motivate learners should be seen as an imperative feature to drive motivation towards students learning. Therefore, in classroom many studies summarized motivational strategiesused byteachers (Alison & Burden, 1997; Halliwell, 2012; Brown, 2011) and learners influenced by these strategies, but teachers also engage students in a momentous roles to facilitate and ascertain learner’s self-assurance and achievement which significantly persuades motivation (Fives & Manning, 2005). To motivate students in the classroom teachers construct set of strategies that they have successfully used to motivate students. From the last decades, different researches raised a question that how much guidance is required to fulfill the students’ needs in learning (Hmelo-Silver et al. 2014; Kirschner et al. 2010; Simons & Klein 2007).

Different researchers describethe worksheets helpful for students to become active thinker, self regulationand self reflective in educational activities, sources of guidance relevant to the problem to enhance student learning (Ertmer& Simons 2006; Saye& Brush 2002; Simons & Klein 2007). Researchers like Hershberger, Zembal-Saul, and Starr (2006) concluded that these are useful for engagement of students during science lessons to think about thinking. On the other hand,as per view of Smith Shah, puzzles raised over 90% of students learning and orientated them to the important topics and feedback by the teacher and considered as an instructional tool consisting of a variety of questions and information intended to guide the students to understand difficult ideas as

they work through it systematically. Wentzel (1998) stated that to increase interest in students hands on activities tend to increase curiosity, effort, interaction, decision maker, manage time to formulate the goals related to activities as well as tends to increase the likelihood, performance and depth of knowledge as well as enhance creativity, collaboration, and cooperation while achieving expected learning outcomes by active engagement. While these activities has a long and successful legacy in different subjects like sciences & math (Haury& Rillero,2013).Encouragement how to learn strategy may help the students in teaching especially when they are struggling with weaker academic performance lower self-efficacy or lower motivation (Margolis & McCabe, 2006; Tuckerman 2013). When students were not willing to do assignments and were less motivated and showing lesser engaged is the state of one of the greater frustration as mentioned by many teachers. For such sort of students, there has no magic formula strategy been determined. For this purpose, the researcher used encouragement as a motivational strategy for such types of students. Rewards andPunishmentBehaviorists talk about rewards & punishment as being the main influence on learning and considered as the two basic motivating forces to help in improvement performance behind every action that humans take in a variety of domains like memory processesvisual search and differentiation and cognitive control. (Bijleveld, Custers, &Aarts, 2013).

In science subjects researches supported students become more rational and efficient learners if a teacher used motivational strategies on regular basis to produce conceptual changes via cognitive engagement, in this way they feel more persistent, independent, problem solver and become better decision makers. On the other hand,Ornstein (2015) suggested that these strategies are important to impart core essential concepts of the science curriculum in the students. While, in America, Ruby (2001) states that by using these strategies children can be fully engaged cognitively for the development of their skills and self motivation.

Teacher is considered as the change agent in the world and has a great influence to create the opportunities for his students to engage positively in education (Deci & Ryan, 2008). Whereas Uguroglu and Wallbert (2001) stated that motivation is the best contributor in children's achievement. When making instructional decisions instructors want to be acquainted with theoretical understanding relevant to the class through instructional role. Teachers should also know how to rely on this knowledge when dealing with issues that involve cognitive engagement of students concerns.On the other hand, Fredricks, Blumenfeld and Paris (2004), Saeed and Zyngier (2012), Reeve and Lee (2014) are of the view that motivation of students can be enhanced by variety of students' cognitive engagement through motivational strategies. Moreover, the teachers have to adopt such interesting motivational strategies like use of worksheets, puzzles, hands-on activities and rewards and punishment which can engage the students cognitively. Since in the past, the promotion of learners' skills through innovative motivational strategies were

not taken into consideration, especially for science students in a developing country like Pakistan, hence they can take part in a very important role and can be pro-active in taming cognitive engagement of student by using motivational strategies to enhance students' learning. According to Palmer (2007), for quality of education cognitive engagement is a vital aspect that is necessary for students learning, how do we know? Whether students are motivated or not and they are fully engaged? If they show interest, they ask answers and questions, they begin working immediately on tasks assigned, and they become happy and enthusiastic. On the whole, very little, on a regular basis students are motivated if any, erudition can happen. Zyngier (2009) states that from the middle years engagement is considered as a challenge and it becomes a discussion debate at research levels and for quality of education and participation of students for their authentic learning aligns students' cognitive engagement with motivational strategies. According to literature, researchers explained many types of students cognitive engagement to assess the student learning where Blumenfeld, Kempler&Kracjcik (2006) are of the view that student cognitive engagement is necessary but not sufficient without proper motivational strategies, and for their academic success, these strategies are complementary to enhance student engagement cognitively. According to Schlechty (2002) cognitive engagement is active only in that way if it has different types where student can be engaged differently as a response to the context, work and the tasks assigned by the teachers within the time and with their peers. During educational process teacher must be well educated, must focus and scrutinize, be inspirational, approachable and best devoted to their students. To fulfill students' present and upcoming needs the content must be precise, appropriate, attractive, & relevant to the students' present and upcoming needs. The method or process must be creative, encouraging, attractive, advantageous, and should give tools which can be practical to the student's existence. Environment should be secure, as much as achievable, positive, accessible, need to be personalized and empowering. On a regular basis, motivation is optimized when students are exposed to a large number of these motivating experiences and variables. (Debnath, 2005; Souza and Maheshwari, 2010; Palmer, 2007). Thus, the study was conducted to engage students not only by the task assigned but also by the task with enthusiasm and diligence.

In Pakistani scenario, the age of elementary school students is approximately between 10-13 years which is logical reasoning stage (11 years onward as cited by Piaget in his age stage model). At this stage thinking skills should be promoted by engaging students cognitively through motivational strategies (worksheets, puzzles, hands-on activities, encouragement, reward and punishment) not simply by using chalk-talk methods as (Ramos and Morales, 2016). On the other hand, Saeed and Zyngier (2012), Reeve and Lee (2014) are of the view that motivation of students can be enhanced by students' cognitive engagement through motivational strategies. Researchers (Ramos & Morales,

2016) have also found that motivational strategies not only benefit the high achievers but also improve the low achievers through cognitive engagement. Several studies have been conducted at international level, but unfortunately no substantial studies have been conducted in the indigenous culture among students at any level, regardless of the fact. This area is still being neglected in Pakistan. It seems to be imperative to conduct research on the importance of students' cognitive engagement/motivational strategies. Recognition of its needs at crucial age (elementary level) provides a solid reason to the researchers to conduct a study which may not only assess the effect of motivational strategies on students' cognitive engagement, but also explore the different types of cognitive engagement with learning (Ryan & Deci, 2009) in general science at elementary level.

To fulfill students' present and upcoming needs the content must be precise, appropriate, interesting, and relevant to the students' present and upcoming needs. The method or process must be creative, encouraging, attractive, advantageous, and must give tools that can be practical to the students' real life. The environment should be safe, as much as possible positive, accessible, need to be personalized and empowering Debnath, (2015). Therefore, researcher used motivational strategies side by side during the study to enhance students' learning by cognitive engagement. Since in the past, the promotion of learners' cognitive engagement through motivational strategies were not taken into consideration, especially for science students in a developing country like Pakistan, the present study would open new horizons of research on the effects of motivational strategies on science students' cognitive engagement. In the global scenario, the major issue of 21st century is the engagement of the learners in a meaningful way. The teachers have to adopt interesting motivational strategies like use of worksheets, rewards and punishment, hands-on activities and puzzles to engage the students cognitively. Hence they play a vital role in cultivating students' cognitive engagement by using motivational strategies to enhance their learning.

Objectives of the Study

The objective of the study was:

1. To investigate the effect of motivational strategies on science students' cognitive engagement.

Null Hypotheses

Ho₁: There was no significant difference between the mean scores on cognitive engagement of pre-test of experimental and control groups.

Ho₂: There was no significant difference between the mean scores on cognitive engagement of post test of experimental and control groups.

Research Instrument

The present study was aimed to investigate the effect of motivational strategies to enhance the science students' cognitive engagement in 7th grade. The researcher constructed a questionnaire on the basis of literature review regarding students' cognitive engagement (QSCE) with reliability 0.87. Furthermore, cognitive engagement was explored through three sub items which consisted of skills (e.g. "I do complete my work on time in the class"), mastery (e.g. "I can learn the difficult topics of science") and mental effort (e.g. "I evaluate my performance and change tactics to increase success"). This scale was related to students learning knowledge and the way students comprehend.

Research Design and Procedure

The researcher used the pre-test and post test, control group design. Both, the two groups were randomly selected from the total available groups and equated on the basis of 6th grade annual examination. One of the two groups was treated as experimental group (30 participants) and the other group was treated as control group (30 participants). Groups were administered a pretest, each group received a treatment through motivational strategies (worksheets, puzzles and hands on activities, encouragement and rewards & punishment), and both groups were post tested at the end of the study. Moreover, the treatment duration was 60 days (2 months). Control group has been taught with the help of black board, chalk and text book. Experimental group has been given treatment. To engaged students cognitively worksheets, puzzles, and hands-on activities were used. During performing hands-on activity, puzzles and worksheets researcher encouraged students by saying like this your writing is excellent "Yes" you can do this, you are genius one, etc. . This study also examined how the rewards and punishment strategy effect students' cognitive engagement, where researcher tied the rewards to increase the students' performance regarding cognitive engagement. Here researcher defined the rewards into different titles, like if any student scores highest (solves the worksheets, puzzles and hands-on activity), then she becomes the monitor, star, counselor member of the class for one week, but if any student failed to achieve the target, then no reward was given and it was her punishment.

Analysis of Data**Table 1**

Pre-test scores difference between Experimental group and Control group on Cognitive Engagement

Groups	N	Mean Score	SD	t- value	Sig.
Experimental	30	91.13	12.59	0.809	0.422
Control	30	88.50	12.63		

Above table reveals that there was no significance difference in the mean score of pre-test of experimental group (M=91.13, SD=12.59) and control group (M=88.50, SD=12.63) at $p < 0.05$. So conclusion is that, both groups have similar level of significance difference between mean scores of pre-test. Hence it can be concluded that experimental and control group have similar mean scores on cognitive engagement.

Table 2

Post test scores difference between Experimental group and Control group on Cognitive Engagement

Groups	N	Mean Score	SD	t- value	Sig.	Effect size
Experimental	30	108.33	7.51	5.893	0.001	1.22
Control	30	89.43	15.87			

Above table reveals that there was a significance difference in the mean scores of post test cognitive engagement of experimental group (M=108.33, SD=7.517) and control group (M= 89.433, SD= 15.87) at $p < 0.05$ with 1.22 effect size. Hence it is clear that experimental group has significantly higher mean scores than that the mean score of control group on students' cognitive engagement.

Conclusion and Discussion

The findings of the study provide empirical support for the claim that the motivational strategies are interlinked and affect students' cognitive engagement. Students' cognitive engagement not only improves learning outcomes but it also aligns good quality courses and training initiatives in various characters of self regulated learning, self efficacy constructs, and successful performance of students within or outside the classroom which presupposes the existence of both "will" and the "skill" to formulate the variation among poor and quality outcomes of students learning. Our findings also suggest that

academic success of students is contingent upon cognitive engagement by using of motivational strategies or beliefs to build abilities and student confidence to be successful in class not only at elementary level but for upper elementary as well as high school level (Greene, et al; 2004; Miller et al., 1996; Wolter & Pintrich, 1998). According to the present study, future research has to be focused on the development of motivational strategies (puzzles, worksheets, hands on activities, encouragement, reward and punishment etc) into consideration subject area characteristics like in science to strengthen young student competency, enrich their personality as well as it also indicates that the result of the study gives experiential information for the role of motivational strategies considered as a mediators in the student performance showing the pathway to engage students effort for cognitively. (Brackett et al., 2009).

The current research highlighted the importance of students' cognitive engagement during the process of learning in schools. Teacher must know why, when and how to design different academic activities to engage the students productively and effectively (Zingier, 2011). Therefore, a teacher provides a well supportive environment through his own teaching methodology for students' better learning (Marsh, 2000). The findings of this study depicted that there is difference among scores of pre test and post test of control group and pre test and posttest of experimental group on students' cognitive engagement and would prove to a significant addition in the existing body of knowledge of the area. Other conclusion of present research showed that there is significance difference among groups of pretest & posttest of control group and pre test & post test of experimental group. Students' cognitive engagement considered as a complex process to increase the level of engagement in students required different motivational strategies which involve students individually in group work within or outside the classroom environment regarding their academic tasks to enrich the student learning. Campbell and Prain (2007) argued that students are not fully engaged during their middle school age. While, Schlechty (2002) are in view that students can be engaged cognitively authentically in the classroom. It is concluded that this experimental research not only presented the contributions but also exposed the advantages of students' cognitive engagement as well as propped up what is new and different in this study while engaging cognitively may to predict, promote and enhance student teacher relationship, creativity, curiosity, interest, good decision making and problem solving, self-efficacy, and mastery goals, self regulation skills, planning, group work to contribute their learning more valuably via cognitive engagement. (Bryson & Hand, 2007; Ryan, 2000; Schmakiel, 2008; Steele & Fullagar, 2009). It can be concluded from the finding of this study that cognitively engaged students are capable of doing their work with enthusiasm, commitment and keen interest and try to command mastery over their learning to achieve highest result whereas, disengaged students do their work but without commitment and interest (Kim & Reschly, 2006; Fredricks et al., 2004; Furrer & Skinner,

2003). The findings are generally inveterate engagement-facilitating effect on changes in general science via students' cognitive engagement through motivational strategies. These findings contribute to the growing literature representing the fundamental part in students' academic performance and their productive learning (Battistich et al., 2004; Brock, Nishida, Chiong, Grimm, & Rimm-Kaufman, 2008; Curby et al., 2009) e.g. It is also concluded that cognitive engagement improves students' skills, mastery, and mental effort while doing worksheets, puzzles and hands-on activities rather than memorization in General science. The present study extends these findings by showing that an omnibus, objective measure of this engagement is related to student learning for his better academic performance.

Other conclusion of the study showed that in experimental group researcher engaged students' cognitively in a positive climate by using different motivational strategies to promote and connected autonomy, sense of belongingness, enthusiasm, interest, curiosity, interaction among their fellows, solving problems and fulfillment of their needs in terms of collaboration as compared to low negative climate while studied control group without engaging students' cognitively which showed fewer problems regarding their learning. It is possible due to teacher who becomes more conscious and responsive towards students both social and academic engagement (Crosnoe, Johnson, & Elder, 2004, Skinner et al., 2008). Our finding confirms the research to introduce different types of motivational strategies (worksheets and puzzles etc) in the general science curriculum (PTTB) at primary and elementary level. As well as arrange training workshops for teachers how to engage students' cognitively differently in classroom to get better results.

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