TRAJECTORY OF STUDENTS' SELF EVALUATION OF PARTCIPATION IN CO-OPERATIVE LEARNING: A COMPARISON BY THEIR IMPLICIT THEORIES

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Abstract

The present study is aimed at understanding the trajectory of students' individual self-evaluation of their participation in co-operative learning amongst students with entity and incremental theories of intelligence. The study adopted the quasi-experimental method in which 78 students of standard IX studying in an English medium school participated. Students' individual self-evaluation were studied using a rubric on 9 dimensions. The data were analysed using graphical technique. It was found that students with entity and incremental theories of intelligence showed that both the groups displayed a stabilising effect of the co-operative learning approach after 16 weeks on the nine dimensions, namely, (a) Contribution to Group Goals, (b) Punctuality, (c) Consideration of Others, (d) Contribution of Knowledge to the Group, (e) Team Work and Sharing with Others, (f) Explanation, (g) Solution, (h) Preparedness and (i) Involvement. Besides, students with incremental theory of intelligence showed a higher score on all the dimensions as compared to students with entity theory of intelligence except on the dimension of 'Consideration of Others' for which both the entity and incremental groups displayed similar effects of co-operative learning. Moreover, the graphs show a consistent improvement in students' self-evaluation of individual performance and participation in the process of learning in both the groups.

Key Words: *Co-operative Learning, Mathematics, Self-Evaluation, Rubric*

Classrooms are very social places but usually in a traditional class, the focus of teachers on individual learning and the social aspects are frequently regarded as a distraction and/or a nuisance. If teachers are able to make positive use of these social aspects and the social arrangement of the classroom, then learning would be enhanced and more permanent. One of the social aspects of a classroom is co-operation amongst students. Co-operative learning refers to those teaching practices that offer opportunities to students to learn together in small groups. Inco-operative learning, students learn together in groups, which are structured in such a way that group members have to co-operate to succeed. Students work together to learn and are responsible for their own as well as their team-mates' learning. The four major reasons for adopting co-operative learning approach in classroom include (a) active learning, (b) mutual

learning help by students, (c) mutual learning support amongst students and (d) enhanced motivation amongst students due to team and individual success.

Implicit Theories of Intelligence: Implicit theories of intelligence refer to the beliefs a student holds about the nature of intelligence. Some students are inclined to see intelligence as a fixed and absolute thing (entity theory or entity belief) and others are inclined to see it as a malleable dimension that can be altered or enhanced(incremental theory or incremental belief). According to Dweck (2000, 2006), individuals develop theories, beliefs, and intensely held schema about human attributes. These beliefs help individuals understand their world and have an enormous effect on how they learn, grow and succeed. These two types of thinking about intelligence are associated with two distinct frameworks, or ‘‘meaning systems’’ (Hong et al., 1999), that can have important consequences for students who are facing a sustained challenge at a critical point in their adolescent lives. Previous research has shown that (a) an incremental versus entity theory of intelligence leads to pursuing learning versus performance goals respectively (Dweck, Tenney, &Dinces, 1982), (b) an incremental versus entity theory of intelligence leads to having positive versus negative beliefs about effort respectively (Hong et al., 1999), (c) pursuing learning versus performance goals leads to a mastery versus helpless response pattern respectively (Elliott & Dweck, 1988; Robins & Pals, 2002) and (d) pursuing learning versus performance goals leads to improving grades (Grant & Dweck, 2003). This implies that a student’s implicit theory influences his process and motivation of learning. The present study is aimed at comparing the trajectory of students’ individual self-evaluation of their participation in co-operative learning on the basis of their implicit theory of intelligence (entity versus incremental theories).

Review of Related LiteratureA large number of studies have shown co-operative learning to enhance students’ academic achievement (Ren-shing, 2006;Bawn, 2007; Kolawole, 2007;Fengfeng and Barbara, 2007; Madrid, Canas and Ortega-Medina, 2007; Tan et al, 2007; Thangarajathi and Viola, 2007; Boaler and Staples, 2008; Kalpana, 2008; Roseth, Johnson and Johnson, 2008; Hargreaves and Pell, 2009; Isik&Tarim, 2009; Johnsen, 2009; Aziz & Hossain, 2010; Dwi, 2010; Gambari, 2010; Gubbad, 2010; Mohammad, 2010; Philips, 2010; Retnowati, Ayers and Sweller, 2010; Zakaria, Lu Chung &Daud, 2010; Kholid, 2011; Pandya, 2011; Punding, 2011; Widodo, 2011; Jebson, 2012; Maney, 2012; Mbacho, 2012; Rendi, 2012; Sean, 2012;Andriani, Kusmayadi&Mardiyana, 2013; Flynn, 2013;Gazali, Riyadi&Roswitha, 2013; Hossain &Tarmizi, 2013; Perwita, 2013; Sulistiyono, Mardiyana& Sari, 2013; Tran, 2013; Aspriyani, Mardiyana& Sari, 2014;Yuwono, Budiyono& Sari, 2014; Ariyani, Mardiyana& Sari, 2015; Astutik, 2015; Asy’ari, Usodo&Riyadi, 2015; Hidayati,

Mardiyana&Saputro, 2015; Miatun, Sujadi&Riyadi, 2015; Viqriah, Budiyono&Subanti, 2015; Wardi, Mardiyana&Iswahyudi, 2015; Hartono, Kusmayadi&Riyadi, 2016; Ikawati, Mardiyana&Saputro, 2016).

Similarly, it has been found to influence other cognitive outcomes such as retention in mathematics (Chinason, Kurumeh&Obida, 2011), mathematical problem solving(Hwang, Chen and Hsu, 2006; Tarim, 2009; Carlan, Rubin & Morgan, 2016; Damayani, Sutawidjaja& Susanto, 2016), academic competencies (Altamira, 2013), academic tasks (Zakaria and Iksan, 2007), students' ability to explain and understand mathematics concepts and problem solving, use of vocabulary and written explanations (Leigh, 2006) and their mathematics conceptual understanding and procedural fluency (Jbeili, 2012).

Prior research has found that co-operative learning enhances affective outcomes of learning such as students' attitude towards mathematics (Ke& Grabowski, 2007;Kalpana, 2008; Ifamuyiwa and Akinsola, 2008;Johnsen, 2009; Mohammad, 2010; Zakaria, 2010;Maney, 2012;Altamira, 2013;Flynn, 2013; Hossain &Tarmizi, 2013; Tran, 2013), attitudes towards co-operative learning (Akhtar, Perveen, Kiran, Rashid &Satti, 2012),interest in learning mathematics (Viqriah, Budiyono&Subanti, 2015), feeling of enjoying mathematics (Regnier, 2009; Bilican, Demirtasli and Kilmen, 2011), patterns of interaction and mathematical thinking (Fonkert, 2012), divergence of ideas, collaborative knowledge building and construction (Puntambekar, 2006), student engagement (Bawn, 2007; Galton, Hargreaves and Pell, 2009; Reszel, 2016), mathematics anxiety (Batton, 2010; Sean, 2015), social skills, behaviours and interactions (Gillies, 2008; Kalpana, 2008; Roseth, Johnson and Johnson, 2008; Sharma, 2008;Artut, 2009; Hargreaves and Pell, 2009; Philips, 2010; Flynn, 2013), self efficacy (Sean, 2012; Sengul&Katranci, 2014), self esteem (Sharma, 2008), motivation(Sean, 2012; Tempelaar et al, 2012; Aspriyani, Mardiyana& Sari, 2014) and perceived classroom environment and critical thinking skills (Goyak, 2009).

Some of the prior studies have included (1) Gender, (2) Locality of the House, (3) Tuition Undergone and Type of Tuition, (4) Cognitive Level (Field-Independence v/s Field-Dependence), (5) Multiple Intelligences, (6) Maturity Level, (7) Metacognitive Scaffolding, (8) SES, (9) Race, (10) Study Domain, (11) Age, (12) Culture, (13) Learning Style and (14) Computer Games as moderator variables.

Need of the Study

Very little prior work on co-operative learning has focused on understanding the trajectory of students' self-evaluation of their participation in co-operative learning approach. It is expected that peer support and team learning in co-operative learning would create an environment

which nurtures students with an entity belief in intelligence. Moreover, in the Indian context co-operative learning approaches been found to be more effective for students with mastery goals (which are a part of incremental theory of intelligence) whereas the traditional lecture method is found to be more effective for students with performance goals (which are a part of entity theory of intelligence) (Pandya, 2011). Very little prior research in the Indian context has attempted to understand students' individual self-evaluation using a rubric for co-operative learning approach in mathematics. This forms the basis of the present research.

Aim of the Study: The broad aim of the research was to understand the trajectory of students' individual self-evaluation using a rubric for co-operative learning approach in mathematics.

Research Question

What is the trajectory of individual self-evaluation of students with entity and incremental theories of intelligence over a period of twenty-two periods as measured by a grading system through the use of a rubric when co-operative learning approach is adopted in the mathematics class?

Methodology

The present study is aimed at enhancing academic achievement in mathematics of secondary students through the use of Co-operative Learning Approach. The researcher has manipulated the method of teaching to ascertain its effect on students' academic achievement in mathematics. Hence the methodology selected is the experimental one. In the present investigation, the researcher has used classified students into two categories, namely, students with (a) entity and (b) incremental theory of intelligence and compared their individual self-evaluation of their participation in the implementation of the co-operative learning.

In order to study, students' individual self-evaluation of their participation in the implementation of the co-operative learning, the exploratory survey method was used leading to quantitative data. The researcher has adopted the co-operative learning approach to ascertain its effect on students' academic achievement in mathematics. Hence the methodology selected is the quasi-experimental one. After the experiment, students' responses to individual self-evaluation of their participation in the implementation of the co-operative learning measured using a rubric were obtained.

Intervention Programme

In the present research, the researcher developed an instructional programme based on Co-operative Learning Model. In the present research, instructional programme on chapters on linear equations in two variables, graphs, ratio and statistics was developed. The techniques used under Co-operative Learning Model in the present investigation included Jigsaw

Technique and Think-Pair-Share. The researcher obtained permission from a selected school for implementing the intervention programme. The researcher first administered the pre-test on Students' Mathematics Achievement Test the experimental group. After the pre-test, the experimental researcher has used this design as it was the most feasible one and the interpretation of the results group was taught using the Co-operative Learning Model. At the end of this, the post-test on Mathematics Achievement Test was administered on the students. Besides, and Rubric for Individual Self Evaluation was administered to students at the end of Period 1, Period 6, Period 11, Period 16 and Period 22 and data were analyzed using graphical technique. The has been cautiously done. The students of standard IX were taught selected topics in Mathematics subject. The intervention programme was implemented on the basis of content from the text books prescribed by Maharashtra state text book production and curriculum research, Pune. In the experimental group, the researcher taught the content matter using the Co-operative Learning Model. Twenty-two periods from the school time table were taken up to teach the content. It was spread over twelve working days. Five days per week were taken up for three weeks, teaching one to two school periods a day of thirty-five minutes duration each. The content was taught in the mornings.

Tools Used in the Study

1. **Implicit Theories of Intelligence (Self-Theory)** : This scale was developed by De Castella & Byrne (2015). It consists of two subscales, namely, Entity Self Beliefs Subscale and Incremental Self Beliefs Subscale with a total eight items. Its reliability and validity were established in the Indian context. Its reliability and validity were established in the Indian context during a pre-pilot study (Cronbach's Alpha = 0.87 and Test-Retest Reliability = 0.82). All items were measured on a 5-point Likert-type scale (1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree). The scoring is done in such a way that a high score implies incremental theory of intelligence whereas a low score implies entity theory of intelligence.
2. **Rubric for Individual Self-Evaluation** : This included nine dimensions, namely, (a) Contribution to Group Goals, (b) Punctuality, (c) Consideration of Others, (d) Contribution Knowledge to the Group, (e) Team Work and Sharing with Others, (f) Explanation, (g) Solution, (h) Preparedness and (i) Involvement measured on a four-point scale. The total score on each dimension in this rubric ranged from 1 to 4 for each individual. It has been adapted to suit Indian conditions and mathematics class in particular from http://www.readwritethink.org/files/resources/lesson_images/lesson95/coop_rubric.pdf.

Participants

In the present research, the sample selected consisted of 78 students – both boys and girls from standard IX of English medium schools situated in Greater Mumbai. The experimental group had 78 students out of which 42 (53.85 %) were boys and 36 were girls (46.15 %). The school selected for the study was affiliated to the SSC Board, Mumbai with English as the medium of instruction. The school was selected randomly using lottery method. However, the experiment was conducted on intact class due to reasons beyond the researcher's control. Moreover, there are 44 students with Entity Theory and 34 students with Incremental Theory of intelligence in the present study.

Techniques of Data Analysis

The study has used the graphical technique for analyzing the data.

Results

Analysis of Individual Self-Evaluation : This was measured using a Rubric for Individual Self-Evaluation and analysed using a line graph. It is essential to mention here that Individual Self-Evaluation of students was measured after Period 1, Period 6, Period 11, Period 16 and Period 22. The data shown here graphically represent Mean score on Individual Self-Evaluation of students through spanning over 16 periods. The graphs show a comparative analysis of Mean score of Individual Self-Evaluation of students with entity and incremental theory of intelligence.

a) **Contribution to Group Goals: This** dimension refers to the extent to which a student feels he/she works towards group goals with keenness and contributes to learning of mathematics as well as trying that the group performs well on mathematics related activities and problem solving. Figure 1 shows students' Mean scores on Contribution to Group Goals Dimension of Individual Self-Evaluation of students over Period 1, Period 6, Period 11, Period 16 and Period 22.

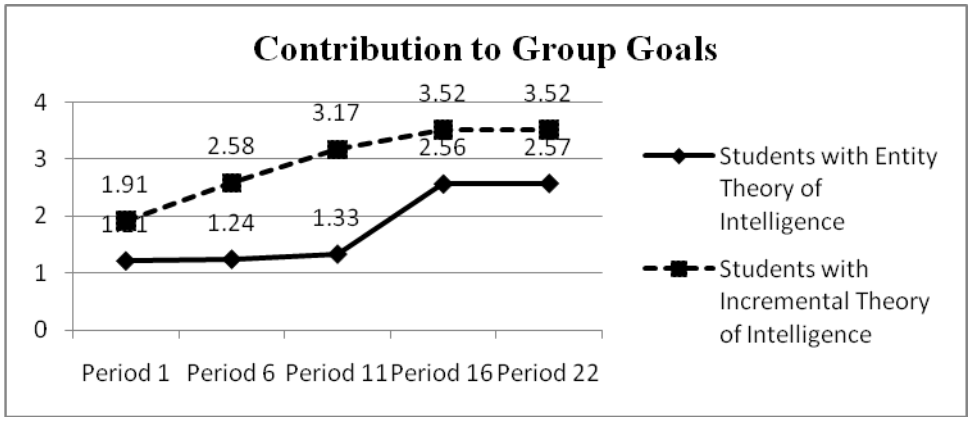

Figure 1

Observation: It can be seen from figure 1 that students with incremental theory of intelligence have a higher mean score on Contribution to Group Goals as compared to that of students with entity theory of intelligence consistently. The increase in the mean score on Contribution to Group Goals continues till Period 16 and then remains stable. In students with incremental theory of intelligence, there is a steady increase in mean score on Contribution to Group Goals whereas in students with entity theory of intelligence, the graph is relatively flat till Period 11 followed by an increase.

b) **Punctuality**: This dimension refers to the extent to which a student feels he/she is always punctual with mathematics related work responsibilities and completes assigned tasks on his/her own.Figure 2 shows students' Mean scores on Punctuality Dimension of Individual Self-Evaluation of students over Period 1, Period 6, Period 11, Period 16 and Period 22.

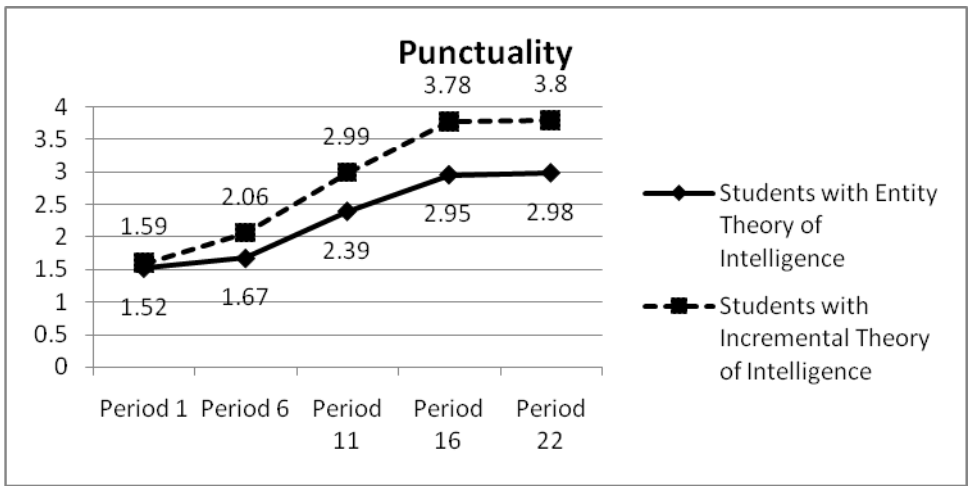

Figure 2

Observation: It can be seen from figure 2 that students with incremental theory of intelligence have a higher mean score on Punctuality as compared to that of students with entity theory of intelligence consistently. The increase in the mean score on Punctuality continues till Period 16 and then remains stable. In students with incremental theory of intelligence, there is a steady increase in mean score on Punctuality whereas in students with entity theory of intelligence, the graph is relatively flat till Period 6 followed by an increase.

c) **Consideration of Others :**This dimension refers to the extent to which a student feels he/she is sensitive towards other students' feelings and learning needs, values his/her group members' knowledge, opinion and skills, encourages group members to contribute in the mathematics class. Figure 3 shows students' Mean scores on Consideration of Others Dimension of Individual Self-Evaluation of students over Period 1, Period 6, Period 11, Period 16 and Period 22.

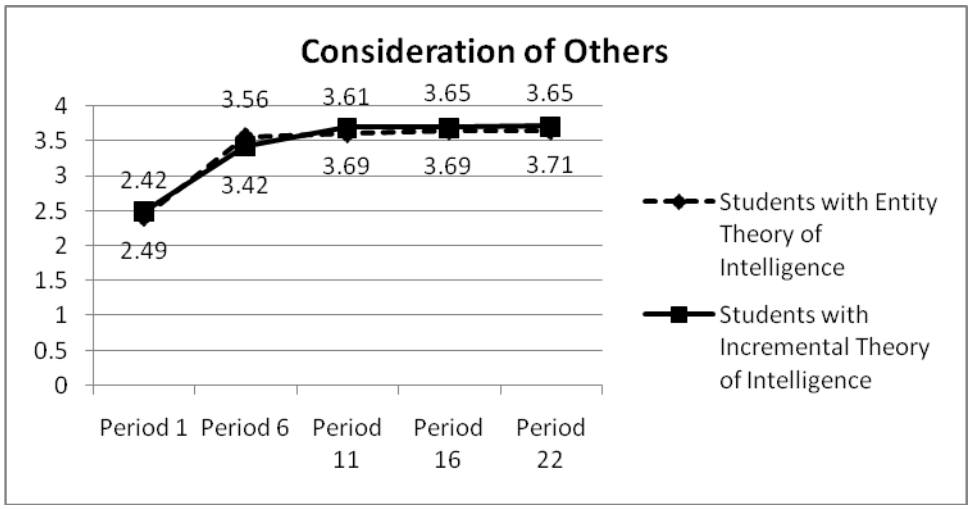

Figure 3

Observation: It can be seen from figure 3 that students with incremental theory of intelligence have almost the same mean score on Consideration of Others as compared to that of students with entity theory of intelligence consistently. The increase in the mean score on Consideration of Others continues from Period 6 onwards in both the groups and then from Period 11 onwards, it remains stable in both the groups.

d) **Contribution of Knowledge to the Group :**This dimension refers to the extent to which a student feels he/she regularly and actively contributes knowledge, opinions and skills without anyone's encouragement or reminder. Figure 4 shows students' Mean scores on Contribution of Knowledge to the GroupDimension of Individual Self-Evaluation of students over Period 1, Period 6, Period 11, Period 16 and Period 22.

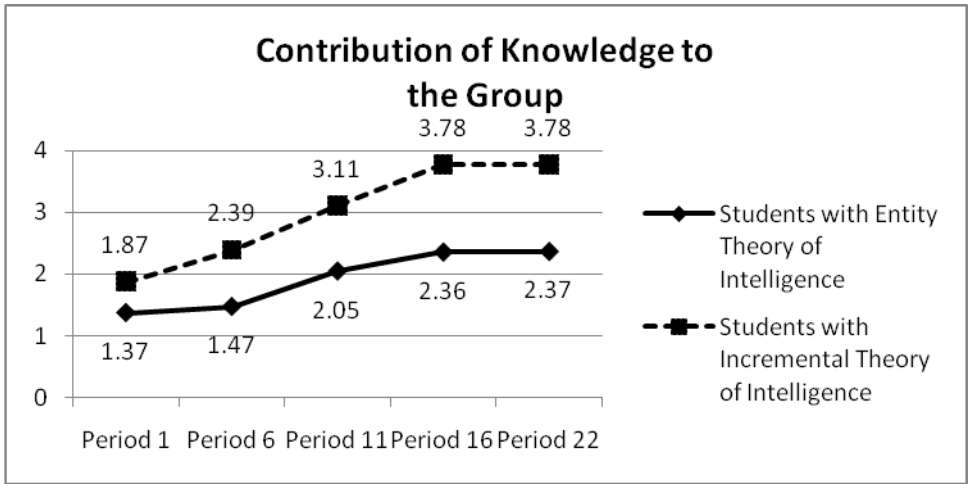

Figure 4

Observation: It can be seen from figure 4 that students with incremental theory of intelligence have almost the same mean score on Contribution of Knowledge to the Group as compared to that of students with entity theory of intelligence consistently. The increase in the mean score

on Contribution of Knowledge to the Group continues from Period 1 to Period16 onwards in both the groups and then from Period 16 onwards, it remains stable in both the groups.

e) **Team Work and Sharing with Others: This** dimension refers to the extent to which a student feels he/she helps the group in identifying necessary changes and encourages group action for change, does the assigned work without encouragement from others. Figure 5 shows students' Mean scores on Team Work and Sharing with Others Dimension of Individual Self-Evaluation of students over Period 1, Period 6, Period 11, Period 16 and Period 22.

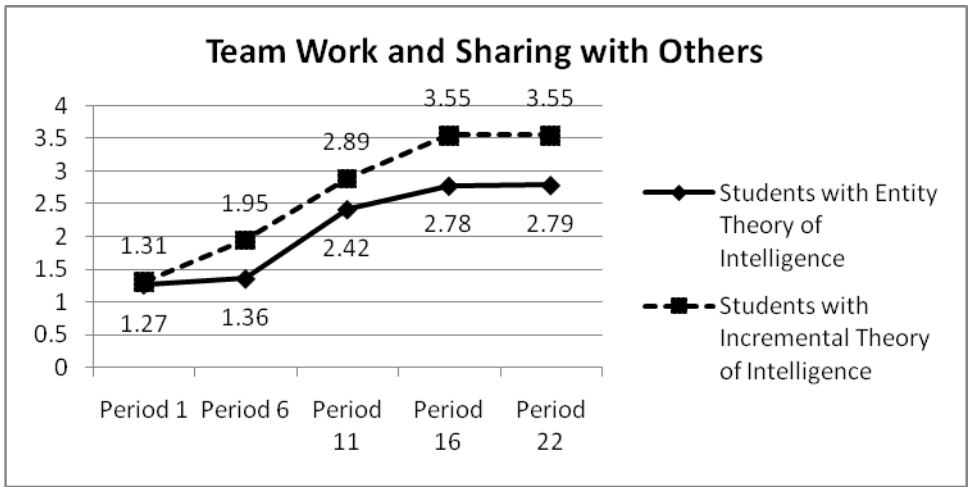

Figure 5

Observation: It can be seen from figure 5 that students with incremental theory of intelligence have almost the same mean score on Team Work and Sharing with Others as compared to that of students with entity theory of intelligence consistently. Initially, the mean score on Team Work and Sharing with Others of both the groups is almost the same. The increase in the mean score on Team Work and Sharing with Others continues from Period 1 to Period 16 onwards in both the groups and then from Period 16 onwards, it remains stable in both the groups.

f) **Explanation** :This dimension refers to the extent to which a student feels his/her explanation is clear, complete and precise, he/ she effectively describes how to solve the problem using strategies or skills presented in mathematics class, uses a visual aid(s) to assist the class in comprehending the problem and his/her voice is audible throughout the presentation.Figure 6 shows students' Mean scores on Explanation Dimension of Individual Self-Evaluation of students over Period 1, Period 6, Period 11, Period 16 and Period 22.

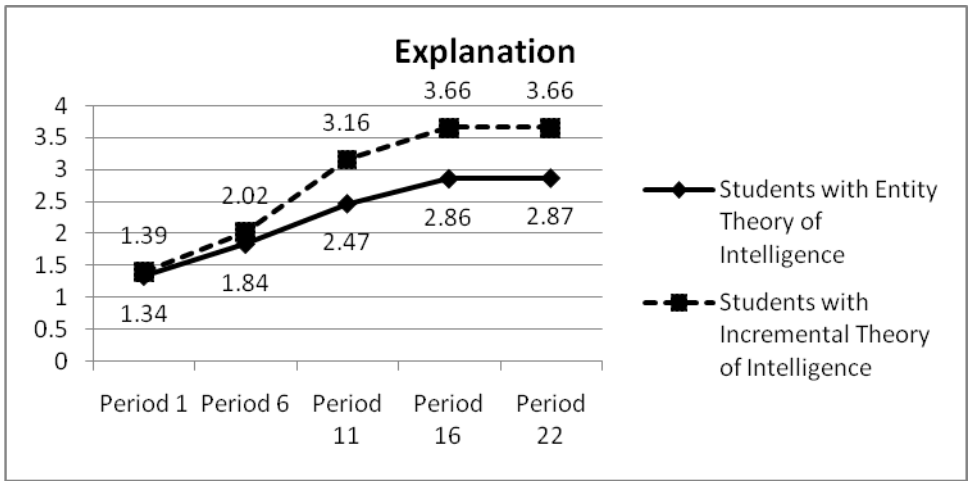

Figure 6

Observation: It can be seen from figure 6 that students with incremental theory of intelligence have almost the same mean score on Explanation as compared to that of students with entity theory of intelligence consistently. Initially, for Periods 1 and 2, the mean scores on Explanation of both the groups is almost the same. The increase in the mean score on Explanation continues from Period 1 to Period 16 onwards in both the groups and then from Period 16 onwards, it remains stable in both the groups.

g) **Solution: This** dimension refers to the extent to which a student feels he/sheshows his/her work for all steps of the problem, solves problems without errors and enjoys solving mathematics problems.Figure 7 shows students' Mean scores on Solution Dimension of Individual Self-Evaluation of students over Period 1, Period 6, Period 11, Period 16 and Period 22.

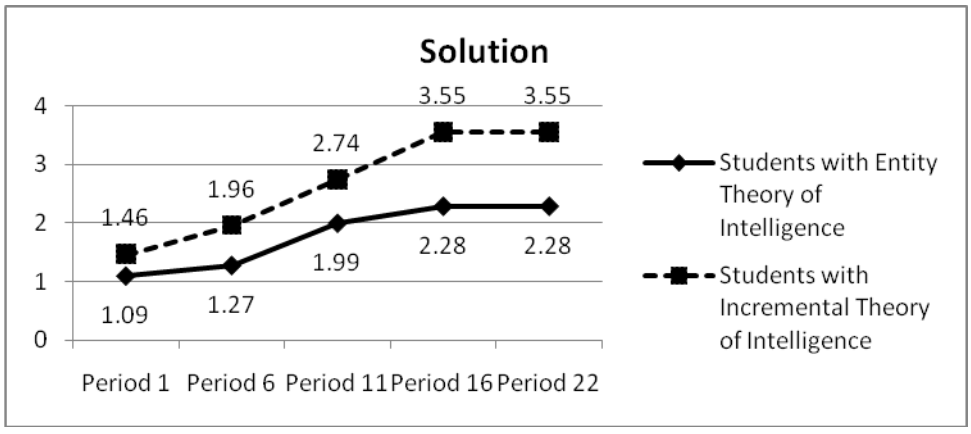

Figure 7

Observation: It can be seen from figure 7 that students with incremental theory of intelligence have almost the same mean score on Solution as compared to that of students with entity theory of intelligence consistently. The increase in the mean score on Solution continues from

Period 1 to Period 16 onwards in both the groups and then from Period 16 onwards, it remains stable in both the groups.

h) **Preparedness :**This dimension refers to the extent to which a student feels he/she is well prepared and ready to present when called on, familiar with the selected problem and is able to effectively explain the solution in a thoughtful way. He/she can make eye contact with the audience for the entire presentation, presentation is well-rehearsed and he/she does not read directly from paper. Figure 8 shows students' Mean scores on Preparedness Dimension of Individual Self-Evaluation of students over Period 1, Period 6, Period 11, Period 16 and Period 22.

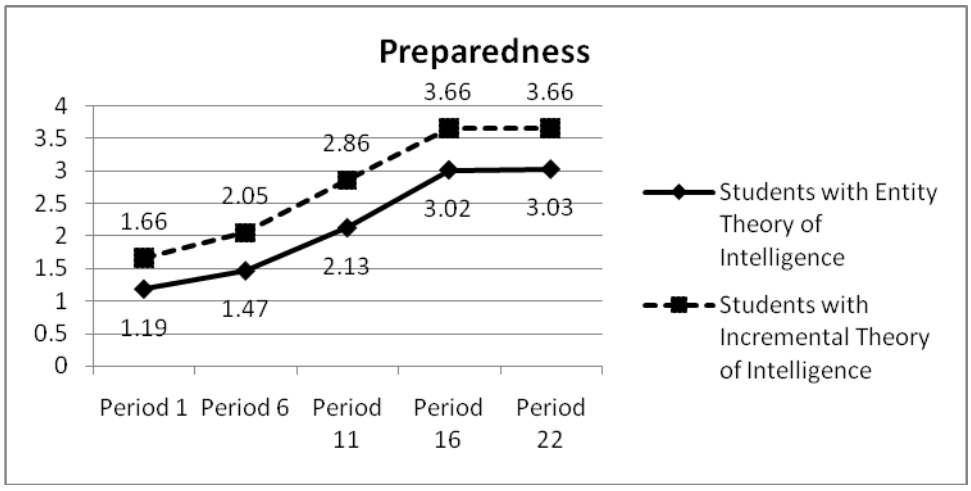

Figure 8

Observation: It can be seen from figure 8 that students with incremental theory of intelligence have almost the same mean score on Preparedness as compared to that of students with entity theory of intelligence consistently. The increase in the mean score on Preparedness continues from Period 1 to Period 16 onwards in both the groups and then from Period 16 onwards, it remains stable in both the groups.

i) **Involvement: This** dimension refers to the extent to which a student feels he/sheasks engaging, insightful and relevant questions which require others to think deeply with understanding of the material and employing critical thinking skills.Figure 9 shows students' Mean scores on Involvement Dimension of Individual Self-Evaluation of students over Period 1, Period 6, Period 11, Period 16 and Period 22.

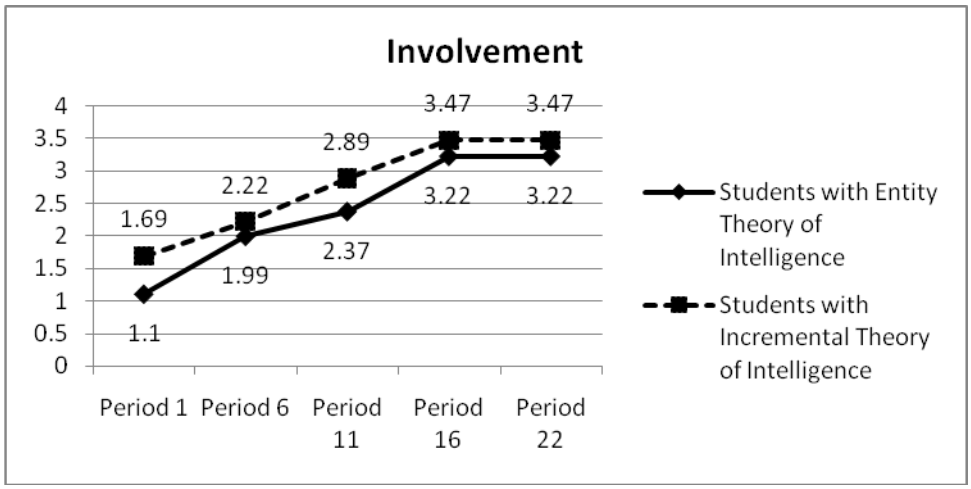

Figure 9

Observation: It can be seen from figure 9 that students with incremental theory of intelligence have almost the same mean score on Involvement as compared to that of students with entity theory of intelligence consistently. However, the distance between the two lines is relatively less in comparison to other graphs. The increase in the mean score on Involvement continues from Period 1 to Period 16 onwards in both the groups and then from Period 16 onwards, it remains stable in both the groups.

Conclusion: The preceding comparisons of students with entity and incremental theories of intelligence showed that both the groups displayed a stabilizing effect of the co-operative learning approach after 16 weeks on the nine dimensions, namely, (a) Contribution to Group Goals, (b) Punctuality, (c) Consideration of Others, (d) Contribution of Knowledge to the Group, (e) Team Work and Sharing with Others, (f) Explanation, (g) Solution, (h) Preparedness and (i) Involvement. Besides, students with incremental theory of intelligence showed a higher score on all the dimensions as compared to students with entity theory of intelligence except on the dimension of 'Consideration of Others' for which both the entity and incremental groups displayed similar effects of co-operative learning. Moreover, the graphs show a consistent improvement in students' self-evaluation of individual performance and participation in the process of learning in both the groups.

Discussion :The reasons for this improvement could be because of the positive motivational influence of peer support for learning. While working in small groups, it is possible that students with incremental theory of intelligence recognize that their rewards are dependent on the success of their teammates and hence are they are more likely to provide support for the learning of students with entity theory of intelligence. This is further corroborated by the assertion that co-operative efforts among groups of students result in a higher degree of accomplishment for all (Slavin, 1984). By helping each other, the students build a supportive

community that raises the performance level of each member including those with entity theory of intelligence. Besides, it is also likely that for students with entity theory of intelligence feel better empowered to learn actively in the co-operative learning approach rather than passively accepting information from the teacher in the traditional class. This feeling of being empowered could lead to enhanced motivation and a positive attitude towards mathematics learning. In the co-operative learning approach, students are actively stimulated to elucidate their actions and thoughts to other student with more powerful and individual level of involvement in learning. Besides, the socialising among students at the professional level in the class in co-operative learning is also likely to improve students' participation and performance in classroom learning for students with entity theory of intelligence. Thus, students with both, entity and incremental theories of intelligence benefit from co-operative learning. The possible reason for students with entity theory of intelligence to be lower on all the nine dimensions of this rubric -as gathered from focus group interviews of students – was because students are traditionally taught to focus on the textbook, notebook and the black-board, not to share work and to be responsible for their own work. Students with entity theory of intelligence might be taking longer time to overcome those values and work together as a team on account of lower confidence and self-efficacy.

Classroom Implications: Teachers need to pay attention to grouping strategies in which a mixed group of students with incremental and entity theories of intelligence could be formed. This is expected to provide positive experience to both the groups and bring about enhanced student engagement and academic achievement in mathematics amongst students with incremental and entity theories of intelligence. Approximately 16 periods are required for students to benefit from the co-operative learning approach especially when the class size is large with 75 or more students.

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