A COMPARATIVE STUDY ON STUDENT ACHIEVEMENT IN SCIENCE THROUGH COOPERATIVE LEARNING AND INDIVIDUALISTIC LEARNING AT NANTAWAN INTERNATIONAL SCHOOL

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Abstract: This study compared the differences in student achievement in science between cooperative learning and individualistic learning. The study had four objectives which were to determine 1) if there is an improvement in student achievement in science through cooperative learning, 2) if there is an improvement in student achievement in science through individualistic learning, 3) if there is a significant difference in student achievement in science between cooperative learning and individualistic learning activities, 4) if there is a significant difference in student achievement in science through cooperative learning and individualistic learning activities by year of study in Nantawan International School. The sample of 64 multinational students from the varying levels of primary Year 3 to 6 were given pretests and posttests through both cooperative and individualistic learning style in order to compare student achievement in science in the second semester of the academic year 2011-2012 at Nantawan International School. A major finding of the study was that there was a significant difference in student achievement in science between cooperative learning and individualistic learning activities in all four year levels from Year 3 to 6 in the direction that cooperative learning activities were more effective than individualistic learning activities for achievement in science. There was no significant difference in student achievement in science through both cooperative learning and individualistic learning activities by year of study in Nantawan International School. As a result of findings of this research, cooperative learning is recommended in the teaching/learning process to improve student achievement in science.

Keywords: Learning Styles, Cooperative Learning, Individualistic Learning, Science

Introduction

Individuals with different learning styles perceive and process information in different and relatively stable ways. The styles are important because they are relevant educational expressions of the uniqueness of the individual differences. Creating alternatives in our instruction such as individual projects, small group discussions, cooperative learning and learning centers can give us flexibility in order to meet these individual learning styles (Kauchak and Eggen, 2003).

Researchers and educators agree that learning styles are formed by the combination of nature/nurture and every single student can be a successful learner if they use their style strengths. Previous studies have shown that students had varying learning styles, and that no single teaching style fulfilled all students' needs. Therefore, teachers need to diversify their teaching styles in order to fit with the students' learning styles (Guild, 1994).

Based on the students' nature, culture, age and background the teachers need to apply the appropriate teaching methods and help the students experience a meaningful learning. As the researcher is teaching science at Nantawan International School; the researcher noticed that many students had difficulties in studying science, because it is being taught in a language other than their home language. Also due to the under achievement in science, student interest and satisfaction of the subject is characterized by a decreasing profile.

As a result of all the above reasons, the researcher is inspired to conduct a study to improve the level of student achievement in science. There are many considerations, which improve student achievement. Unquestionably, the quality of teaching-learning process is one basic consideration to be made, to improve the level of student achievement even though the influence of other factors such as student background, nature and previous learning experiences exist.

Thus, the researcher focused on the teaching-learning process through cooperative and individualistic learning to improve student achievement, in the second semester of the academic year 2011- 2012.

Research Objectives

1. To determine if there is an improvement in student achievement in science through cooperative learning.
2. To determine if there is an improvement in student achievement in science through individualistic learning.
3. To determine if there is a significant difference in student achievement in science between

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cooperative learning and individualistic learning activities.

4. To determine if there is a significant difference in student achievement in science through cooperative learning and individualistic learning activities by year of study in Nantawan International School.

Conceptual Framework

This study aimed to analyze and measure the differences in "student achievement," by the use of two different learning styles and in order to achieve the research objectives the researcher conducted pretests and posttests on four different classes from different years of study at Nantawan International School, before and after using each learning style activities. Figure 1 shows the conceptual framework of this study.

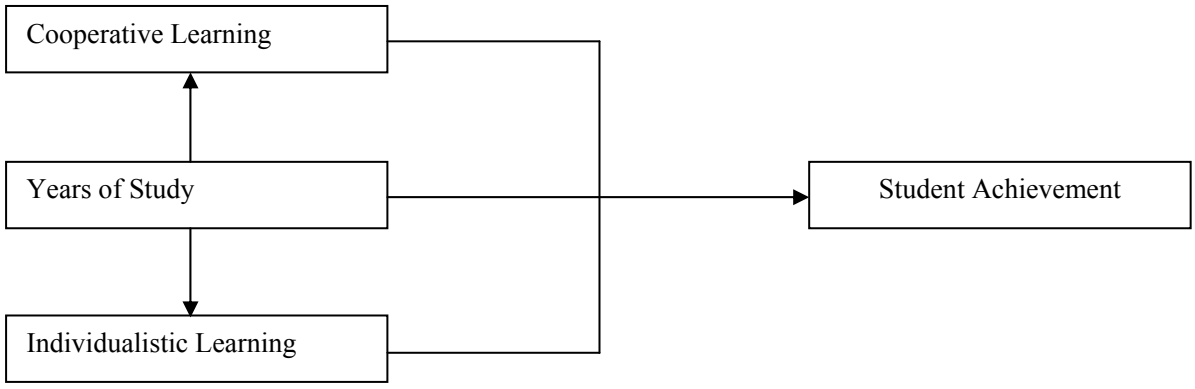

Figure 1: Conceptual Framework of this Study

Review of Literature

This presents related studies to the research conducted by the researcher in the area of using different learning styles and their subsequent outcomes in terms of student achievement. The chapter basically consists of Constructivist Learning Theory, Learning Styles, Cooperative Learning, Individualistic Learning and English for Specific Purposes (ESP) Theory.

Constructivist Learning Theory

Constructivism is a theory that assumes knowledge cannot exist outside the minds of thinking persons. Novak & Gowin (1986) define constructivism as the notion that humans construct or build meaning into their ideas and experiences as a result of an effort to understand or to make sense of them. Constructivism emphasizes the importance of each pupil's active construction of knowledge through the interplay of prior learning and newer learning. Connections are sought between the prior and newer learning and they are constructed by the learners for themselves (Martin, Sexton, Wagner & Gerlovich, 1998).

The constructivist believes that each learner must construct meaning for himself or herself, that the only learning that can take place is that which is connected to the individual's already-existing knowledge, experiences, or conceptualizations. What children learn is not a copy of what they observe in their surroundings, but the result of their own thinking and processing (Martin, 2003).

Constructivist theories draw heavily on the work of Piaget and Vygotsky which emphasized that cognitive change can only take place when previous conceptions go through a process of unsteadiness with the new knowledge obtained (Slavin, 1995). According to Piaget is that individuals go through four stages of development. A different way of understanding the world makes one stage more advanced than another. Cognition is qualitatively different in one stage compared with another. In other words, the way children reason at one stage is different from the way they reason at another stage (Santrock, 2009).

On the other hand Vygotsky focused more on the social aspect of teaching-learning process. According to Vygotsky, mental functions have external or social connections. Vygotsky argued that children develop more systematic, logical and rational concepts as a result of dialogue with a skilled helper (Santrock 2009).

According to Lorsbach and Tobin (1992) other persons are part of our experiential world, thus others are important for making meaning. "Others" are so important for constructivists that cooperative learning is a primary teaching strategy. A cooperative learning strategy allows individuals to test the fit of their experiential world with a community of others. Others help to constrain our thinking. The interactions with others cause disruptions and by resolving the disruptions individuals make adaptations to fit their

new experiential world. Thus, from a constructivist perspective, science is not the search for truth. It is a process that assists us to make sense of our world. Actively engaging students in science is the goal of most science education reform and using constructivism as a referent can possibly assist in reaching that goal.

Scientific ideas and theories not only result from the interaction of individuals with phenomena, but also pass through a complex process involving communication and checking through major social institutions of science before being validated by the scientific community. This social dimension to the construction of scientific knowledge has resulted in the scientific community sharing a view of the world involving concepts, models, conventions, and procedures. This world is inhabited by entities such as atoms, electrons, ions, fields and fluxes, genes, and chromosomes; it is helpfully organized by ideas such as evolution and procedures of measurement and experimentation. These ideas, which are constructed and transmitted through the culture and social institutions of science, will not be discovered by individuals through their own empirical inquiry; learning science involves being initiated into the culture of science (Steffe & Gale, 1995).

Learning Styles

The concept of learning styles has been regarded as one of the important factors that explain individual differences in teaching and learning process. This concept is related to individuals' preferences, interactions, reactions and experiences with learning environment.

In order to describe learning styles and to analyze which factors affect learning styles, many studies have been conducted for more than 40 years. In the literature various definitions of learning styles can be found according to some basic features. According to Dunn and Dunn (1992), learning style is the way in which every individual begins to concentrate process and retain the new and difficult information. And this interaction happens differently for every other learner. Cognitive style theory claims that individuals' learning preferences vary considerably based on their learned or inherited traits (Dunn and Dunn, 1992). Some learn most effectively from things they hear, others learn best when they see material in writing. Some can concentrate only in the environments that are totally quiet; others like to learn in noisy, active environments. Some learn best when they are on their own and work in their own pace, others learn better when they interact and work with their peers in groups.

As the learning styles inevitably differ among students in the classroom, Dunn and Dunn (1978) claim that teachers should try to make changes in their classroom that will be beneficial to every learning style. Some of these changes include room redesign, the development of small-group techniques, and the development of Contract Activity Packages.

Although no learning style is inherently better than another, it is important to be able to work comfortably no matter what style is required in a given course. An awareness of student's learning style can be helpful in emphasizing student's strengths and helping them compensate for their weakness (Gardner & Jewler, 1997, p.71).

Cooperative Learning

Cooperative learning refers to instructional methods in which students work together in small groups to help each other learn. Many quite different approaches to cooperative learning exist. Most involve students in four or five member, mixed ability groups working on assignments. Cooperative, student-centered learning has been widely explored and is becoming a frequently used instructional strategy. Many practitioners have reported that cooperative learning strategies enhance academic achievement (Costa & Kallick, 2004; Slavin, 1999). Cooperative learning offers many benefits to students, as it improves both academic learning and social skills; for teachers it is an aid to classroom management and instruction. Cooperative learning enhances students' enthusiasm for learning and determination to achieve academic success (Lan & Repman 1995, p.54 cited in Orlich et al., 1998, p.275). Many potential benefits arise when cooperative learning is used in instruction; students can enhance their social skills, have more chance to appreciate the differences, can be more individuation of instruction, student participation can increase, anxiety can decrease, motivation and positive attitude toward class can increase, self-esteem and self-direction can increase and finally academic achievement can increase (Lie, 1998). However, some educators still consider cooperative learning strategies to be ineffective. The reason for this might be improper implementation of this widely used strategy because many reports tell of greater student achievement when cooperative learning strategies are used and properly implemented. Teachers play a central role in setting up the conditions for cooperative learning, therefore as Welch (1998) recommended (cited in Mueller & Fleming, 2001) teacher education programs should develop courses and field experiences to introduce prospective teachers to cooperative and collaborative classroom methods.

Dougherty et al.,(1995) came to a conclusion from their research that cooperative learning with enhanced communication can have a positive effect

on both student learning and retention but also they pointed out that the effect is greater when there is greater amount of structure in the cooperative interactions. Kagan (1990, p.12) claimed that teachers who are well versed in a variety of team structures can create skillful lessons that engage and enlighten their students.

Nesbit and Rogers (1997) observed how various cooperative learning strategies were used to support students' reading and writing skills in science instruction. They wrote: "One of the goals of science education is to prepare a scientifically literate citizen who can problem-solve everyday science-related societal issues. . . To do so, citizens must develop their critical thinking skills, read the pros and cons of controversial issues, and then make the most rational, defensible decision they can. Cooperative learning is an especially effective method to use, with any problem-solving task because it encourages people to express divergent points of view" (p.2).

Therefore, cooperative learning through science instruction promoted lifelong decision making skills in the learners. Nesbit and Rogers found that cooperative learning strategies did not simply enrich reading and writing abilities of students, but that their problem-solving abilities emerged as well.

Individualistic Learning

Humans do not always interact with others. Sometimes people desire solitude. Hiking to a mountain lake, walking along a deserted shore, recording thoughts in a journal, reflecting on one's goals, planning one's day, memorizing lines in a play and even writing a book are activities often done alone. Sometimes individuals prefer to act independently from each other without any interdependence existing among them. Individualistic efforts are working alone to accomplish goals unrelated to and independent from the goals of the others. Whether an individual accomplishes his or her goal has no influence on whether other individuals achieve their goals. Within individualistic situations, individuals seek outcomes that are beneficial to themselves. Individualistic learning is working by oneself to ensure one's own learning meets a preset criterion independently from the efforts of other students (Johnson & Johnson, 1999).

Students may be permitted to learn at a predetermined pace, or they may be allowed to work at varying paces. Considering the principles of learning there is much evidence which supports the belief that optimum learning takes place when a student works at his or her own pace, being actively involved in performing tasks, and experiencing successes in learning (Kemp, 1994, p.141). Dunn and Dunn, 1978; argue that individuals are different in the ways they perceive and process information and in the manner in which they most effectively learn.

Throughout the school days and at home, students work on their own to learn; they read books, write papers, listen to tapes, watch a visual presentation, or work at a computer terminal. Ideally, when learning alone, students are highly focused on the instructional task. They tune out distraction in the environment as they work in their own learning space and with their own materials. Students realize they are responsible for completing the instructional task and they must depend on their own personal resources and motivation to get the job done. (Putnam, 1997, p.9)

Being able to work individualistically on one's own when it is appropriate is an important task. Individualistic efforts, however, must be appropriately structured to avoid a number of problems and barriers.

English for Specific Purposes (ESP Theory)

English for Specific Purposes (ESP) which focuses on helping students to learn the specialized English used in a specific discipline and developing the language skills required by students in a specific field should be valued as one of the potential solutions to the difficulties that EFL students are facing during their science education (Cheng, 2011). According to Cheng (2011) there should be collaboration between science teachers and EFL/ESP teachers to teach students the basic science words and concepts in English.

Teaching science to children for whom English is a second language is complex. Not only must teachers help such children develop facility in the scientific processes and methods of inquiry, but they also must help children do so in a language with which their familiarity ranges from none to some. In addition, because of the difficulties in communicating, teachers cannot be sure whether any problems children may be having with science represent low achievement or limited facility in English (Martin, 2003).

Abruscato (1996) stated that hands-on, discovery based experiences can be a great confidence builders for children whom English is a second language even if their reading and language arts skills are weak. Having cooperative learning groups and peer tutoring can also help to enrich child's understanding of science concepts.

Research Methodology

The research design used in the research was a comparative-quasi-experimental design and was used to estimate the casual impact of an intervention on its target population. The researcher used a convenience sampling for her research. The students were tested for their academic achievement in each learning style and the data gathered from the pretests and posttests

through each learning style was encoded statistically and then analyzed.

The study was conducted on the students of Year 3 to 6 studying in Nantawan International School, at the second semester of academic year 2011-2012 within the period of 23rd January to 23rd March. The population was all the students studying at Nantawan International School and the sample chosen were 15 Year 3 students, 22 Year 4 students, 17 Year 5 students, 10 Year 6 students with a total number of 64 multinational students studying science in Nantawan International School during the academic year 2011-2012. Pretests and posttests were the research instrument given to all the students individually before and after each type of learning style period and were created by the researcher herself as being the science teacher of year 3 to 6 in Nantawan International School. Student attention to the instruction, their class participation, group discussions and submitting the assignments were also observed and recorded in the "classroom observation and recording sheet" which was also designed and created by the researcher herself.

Descriptive statistics were used to analyze the data obtained and scoring of the instruments used. A t-test was used to compare the means of pretests and posttests and to compare the means of two different learning styles. One way ANOVA was used to compare the means of four different groups based on their years.

Findings/Results

From the analysis of data, the findings were as follows:

1. Both the use of cooperative learning and individualistic learning strategies increased the student achievement in science significantly for all the year levels of study from Year 3 to 6.
2. There was a significant difference in student achievement in science between cooperative learning and individualistic learning activities in all four year levels from Year 3 to 6.

Students' gained scores of pretests and posttests through cooperative learning were significantly higher than the gained scores through individualistic learning, which implied that cooperative learning activities were more effective than individualistic learning activities for achievement in science.

3. There was no significant difference in student achievement in science through both cooperative learning and individualistic learning activities by year of study in Nantawan International School.

The improvement in student achievement in science was as good in each and every year level of study through both cooperative learning and individualistic learning activities.

Discussions and Conclusion

The purpose of this study was to explore the effects of cooperative learning and individualistic learning activities in science education and to see which method was more effective on student achievement in science. Learning styles play an important role in teaching-learning process and can be used to enhance student achievement. But the educators always have to keep in mind that there will always be some students to learn more effectively through groups and some others through self-learning.

The findings of this study were similar to some other previous researches and were reassuring the results of them. As Abruscato (1996) stated, having cooperative learning groups helped to enrich child's understanding of science concepts as well as their basic language skills when they were EFL students. The observations made in the classroom during the research were similar to Lan & Repman 1995, p.54 cited in Orlich et al., (1998, p.275), that cooperative learning enhanced students' enthusiasm for learning and determination to achieve academic success.

During the cooperative learning periods in all year levels, there was more noise compared to individualistic learning periods. But it was a productive noise made by discussing the results, explaining the concepts and evaluating their own work. It was observed that classes were effective depending upon how well the class planned and how greater amount of structure was involved in the cooperative interactions. Teachers play a central role in setting up the conditions for cooperative learning, therefore as Welch (1998) recommended (cited in Mueller & Fleming, 2001) they should be well educated to implement cooperative and collaborative classroom methods properly.

Through the use of cooperative learning, students developed themselves on their social and communication skills. Students would compete with each other while working as a team which creates enthusiasm and aliveness in the classroom. Slavin (1995) stated, when the classroom is structured to allow students to work cooperatively on learning tasks, cooperative learning offers many benefits to students, as it improves both academic learning and social skills. Students also developed a sense of responsibility as a group when they were subjected to cooperative learning. There was competition which motivated them to work hard. The leaders of the group took it as their responsibility to make sure that the work was being done and everyone was participating. Therefore cooperative learning also provided the students with responsibility as well as the social skills.

Individualistic learning activities proved to be easier to handle for the teacher and allowed for better

classroom management as compared to cooperative learning activities. However as Kagan (1990) claimed, the use of a variety of team structures helped to create skillful lessons that engage and enlighten the students. It is easier for a teacher to manage a classroom and keep it in order when it is well organized.

Most of the students in every year level of study from Year 3 to 6 expressed that cooperative small group learning was a fun and easier way to learn science compared to individualistic learning activities whereas only a few of the respondents found individualistic learning to be a better environment for them to concentrate. In cooperative learning period the students helped and supported each other, and made the most of the opportunities for sharing their experiences and skills with each other. They liked to be in charge of their own learning together with the group members and received immediate help from each other.

Structuring the cooperative learning activities in a way that follows the five basic elements which were suggested and implemented by Johnson, Johnson and Holubec (1990) as cited in Johnson, Johnson and Smith (1991) helps to resolve different issues that might arise during the cooperative learning periods. As Welch (1998) stated (cited in Mueller & Fleming, 2001) improper implementation of cooperative learning might lead to an ineffective outcome.

The findings of this study indicated that the students of every year level from Primary Year 3 to 6 gained higher scores in science by the use of cooperative learning strategies. Therefore it is a recommendation to use different instructional methods in science teaching, such as cooperative learning, in order to enhance students' learning and achievement.

Recommendations

Recommendations from this study are directed to 2 different areas: Recommendations for Teachers and Recommendations for Future Research.

1. Recommendations for Teachers

To improve the use of cooperative learning activities and to help teachers to implement cooperative learning into their teaching properly, the following recommendations are made:

1. Science teachers are encouraged to implement cooperative learning strategies into their project based and inquiry teaching as it is a meaningful tool for student-centered learning and leads to an increase in student achievement in science.

2. Teachers should use cooperative learning strategies in their teaching as it provides students with an opportunity to practice social skills and group interaction skills that will help them in the future.

3. The lesson should be well planned and the learning groups should be well structured for the cooperative learning to be effective, being aware of the probability that some students can be overly dominant and others a free-rider.

4. Teachers also should provide students with feedback on the functioning of the groups in cooperative learning and take notice of students who need assistance in learning.

2. Recommendations for Future Research

1. This research is limited to its respondents studying science in Nantawan International School. Therefore it is suggested that the future research should examine the same variables used in this research but on a larger scale by using respondents of other schools.

2. This research was done over a period of 2 months. This may not be the most effective way to observe the effects of each learning style. A study can be done over a longer period of time such as a year or two, to be more effective and to provide better and more accurate results on the same topic.

3. This research is limited in its findings as the learning content was different between cooperative learning and individualistic learning period because of using the same group to observe both styles. Therefore future research can be done using different groups from the same year level of study and the same learning content can be taught by using cooperative learning activities for one group and individualistic learning activities for the other, so that the comparison might have a higher possibility to be free of confounding.

4. Cooperative learning could be investigated in different subjects, different areas and different school settings in order to see the impact of its use on student achievement in different areas.

5. Further research should be done to discover students' satisfaction and interest towards each learning style as it is so critical for learner motivation for learning.

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