PEER TUTORING: AN EFFECTIVE STRATEGY TO ENHANCE THE TEACHING AND LEARNING OF MATHEMATICS IN SECONDARY SCHOOLS

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Abstract

Peer tutoring and cross-age tutoring are teaching strategies that utilize one-on-one instruction. The usage of the terms peer tutoring and cross-age tutoring are sometimes confusing. Peer tutoring involves a situation in which the tutor and the tutee are of approximately the same age. Cross-age tutoring involves a tutor who is older than the tutee. This article highlights how peer tutoring works as a teaching strategy to enhance the teaching and learning of mathematics in secondary schools. It also includes the back history of peer tutoring and its vital roles in teaching and learning in general.

Introduction

Peer tutoring is defined as an instructional system in which students teach other students. Many scholars have defined peer tutoring in various ways. According to Thomas (1993), sees it as the process by which a competent pupil, with minimal training and with a teacher as guidance, helps one or more students at the same grade level to learn a skill or a concept. Ganstad (1993), states that, peer tutoring occurs when tutor and tutee are the same age. In cross-age tutoring, the tutor is older than the tutee. Peer tutoring is an effective and powerful instructional procedure whose activity involves all the students in a classroom. It provides mastery, accuracy, and fluency. Peer tutoring is an instructional approach in which one child instructs another child in materials in which the first is an expert and the second is a novice. Peer tutoring refers to an alternative teaching arrangement in which peers serve as instructional agents for their classmates or other students.

In peer tutoring, students are paired in twos. This pairing provides them with opportunities to talk about ideas and listen to each other. This pairing enables teachers to interact more closely with students. The interaction provides opportunities for students to exchange mathematical ideas and hence develop their ability to communicate and reason. Harris (2002) opined that, placing students in pairs to work together can empower them to become more independent on their own learning. Peer tutoring can be used as an effective teaching strategy because tutor can adapt instruction to the learner's pace, learning styles and level of understanding (Guastad, 1993). Comments and corrections are made by the students and teachers. Misunderstanding can easily be identified and corrected, and more difficult materials introduced to enhanced students curiosity and interest in building mathematics concept.

O' Donnell (1999), peer tutoring nature of dialogue is quite different from the typical teaching that occurs-in classroom interaction. A typical teacher find it quite difficult to replace the detailed dialogues that are tailored to meet the need of a specific student in mathematics concept utilization in peer tutoring. One-on-one tutoring provides favourable conditions for a student to become an active/self-regulated learner. O'DonnelPs research also shown that educational researchers regularly called for conducive environments that would foster students to be "inquisitive, self-motivated, and rectifying their knowledge deficits. In peer tutoring approach, the tutor is responsible to identify students' error, diagnosing the cause of the error, and shepherding the students through a correct solution path.

Slavin (1980), argued that, peer tutoring has a reward structure where co-operation is at its core. The design of a tutoring program is governed by its goals. Included in these goals are age group targeted, subject area to be studied, and by the availability of human, physical, and financial resources. In applying the strategy of peer tutoring to the teaching and learning of mathematics, setting goals are important so that individual progress can be measured and examined. Also, guidelines are necessary in the selection process to match tutor and tutee.

O' Donne! (1 999), and Harris (2002), stated six conditions that may be satisfied for successful transmission of knowledge through peer tutoring. These are:

(1) "The tutor must provide relevant help"

(2) "Appropriately elaborate",
(3) "Timely",
(4) "Understandable to the target student"
(5) "The tutor must provide an opportunity for the tutee to use the new information", and
(6) "The tutee must take the advantage of that opportunity".

Historical Background of Peer Tutoring

Peer tutoring was first developed by Andrew Bell in 1789 in England, Bell developed a system in which each class was paired into tutors and tutees and was assigned an assistant teacher who supervises the tutors. Bell discovered that the effect of the system in raising pupils' attainment appeared to be substantial (Topping, 1988). In 1801, Joseph Lancaster had the idea that "boys who know little could teach boys who know less. Lancaster developed in England, a program in which monitors and assistant monitors were used in each class to ensure that pupil help others.

Peer tutoring promote a situation in which students achieve higher level of thinking at a quicker rate than they might if they worked independently. Research also indicates that rate of accurate responding to basic mathematics facts increases when peer tutoring strategy is applied, Harper (1990). Wagner (1982), historically traced peer tutoring in Western civilization specifically America back to Greece in the first century A.D. and through Rome and other European country. Application of peer tutoring was substantially increase in the 1980's when the wave of students who are under prepared was admitted to colleges through open admissions and needs to be helped. Since then, tutoring programs have pervaded higher education and researchers have examined the fundamentals of the tutoring process to discover how and why the process work article attempts to highlight some insights on how peer tutoring as a teaching strategy enhance the teaching and learning of mathematics in secondary.

Guidelines for implementing Peer Tutoring

Peer tutoring whether class-wide, one-on-one or in small groups must be properly implemented in order for it to work effectively. Because of this, there are a number of factors that must be carefully considered, Cassanova, ()990), argued that, teachers wanting to implement peer tutoring (in. mathematics) are required to plan and prepare lesson that take into account elevated noise and workout schedules problems. The teachers should teach the behaviours and skills that enhance peer learning according to Fantuzzo (1990).

One important initial factor that must be considered is choosing both tutors, tutee and pairing them. A potential peer tutor (in mathematics) should possess leadership skills, be able to identify the interest of other students. Tutors are often expected to be academically capable and be able to explain the concept to be taught. Tutees are usually slow learners or students with learning disabilities.

In choosing tutors and tutees there are guidelines that must be followed in pairing (matching) them.

Matching Tutors and Tutees

How are tutors and tutees paired (in mathematics)? Some of the factors to be considered are gender, ethnicity, class level and similarity in achievement level Hartman (1997). In pairing tutors and tutees "likeness" is also important even though gender, ethnicity and some other factors may affect the pairing of tutors and tutees. Research suggests that the "best pairing occurs when both tutor and tutee share similar academic achievements and similar social characteristics. These similarities help tutor and tutees to collaborate because they may see each other as equals and thus, communicate with each other. These similarities help tutors and tutees establish bonds and make tutoring a less threatening experience.

Training of Tutors

After pairing tutors and tutees, the teacher needs to ensure that tutors are adequately prepared for each tutoring session. Tutors are not mini-professors, so they are not expected to know everything. Tutors (in mathematics) after add, refine or change their tutee content knowledge. Thus, tutors are trained to understand tutee's learning needs and hence address these needs, tutors are sometimes-viewed as teachers to their tutees, and hence tutors are trained to maintain a certain level of professionalism.

Planning Tutoring Session

Putting peer tutoring into practice requires planning. Some factors that need consideration includes; when, where, the length and frequency of each session. Other factors includes, time span and

physical size of each session. As a mathematics teacher, you need to decide how many students" you want to involve initially and eventually in peer tutoring. It is recommended that teachers start-with very small groups and expand gradually over time.

The length and frequency of tutoring sessions depends mainly on the content to be covered" and the time in which it should be covered (Harris, 2002). Some literature suggests that class-wide peer tutoring sessions should be 15-30 minutes in length depending on the content. Tutoring sessions can be conducted before, during or after regular instructional periods, if tutoring is administered during regular teaching and does not include all the students, the teacher need to consider factors such as classroom space, which may be limited.

Monitoring

Monitoring is the process of checking up on yourself (implementer) and the students while tutoring occurs. Effective monitoring and assessment will require careful personal observation of the students' participation in the session. Tutoring session that takes place within instructional periods are more difficult to monitor and it would be best to schedule small sessions outside of regular instructional periods. Monitoring can be done through self-questioning such as how well do the students understand the important concept? Can the students explain and identify certain differences,

Evaluation of Peer Tutoring

Evaluation in this sense, is grading what the mathematics teacher and this students did in the tutoring session. Evaluation helps the teacher to determine the progress of the tutoring session. Evaluation can be carried out at any strategic point throughout the entire program in form of testing or self-questioning. Examples of such questioning include: how did the students do overall? Did I forget anything important during the program? How can I improve the pace of the session?

How Peer Tutoring Teaching Strategy Enhances Mathematics Teaching and Learning

Peer tutoring strategy helps to promote students social skills and increase their academic achievement in mathematics in the following ways:

(a) Students become more responsible and accountable in the process of helping one another.
(b) Often times, explanations from peer more relevant and under stood by another peer.
(c) While tutoring the student who is doing the teaching gain valuable experience since he is given the opportunity to view the content from a different perspective, present an explanation of the concept and be exposed to another students thinking process.
(d) Peer and cross-age tutoring in mathematics lesson provide students and teachers extra source of instruction which enable the mathematics instructor to utilize time more effectively and increase student achievement, problem solving skills, independence and self-initiative for tutors and tutees.
(e) The peer tutoring as a teaching strategy in mathematics help the implementer to monitor and assess the progress of each tutoring session, and evaluate the achievement of his set goals in each topic treated. Hence, the implementer is able to make improvement and adjustment of his procedures where necessary.

How Peer Tutoring Works as a Teaching Strategy in a Mathematics Class

The procedure requires 30 minutes. Student are paired randomly or matched by ability for example, same level or adjacent level or language proficiency to partners and team each week. Each team or group consist a tutor-tutee (teacher-student). Students' roles are exchanged within the daily tutoring sessions, allowing each individual to be the tutor/teacher and the tutee/student. Tutoring pairs are changed on a weekly basis when a new content is to be learned. Restructuring weekly teams ensures that all students are on a winning team sooner or later. Students are trained in the procedures necessary to act as tutors and tutees. In a given session, the students know who they are to pair with for tutoring, the material to be covered, how to correct errors, how to award points for correct responding, and how to provide positive feedback. Teachers (implementer) organize the academic content to be tutored into daily and weekly units and prepared materials to be used in the Class Wide Peer Tutoring (CWPT) format. In order to provide feedback to the students on their level of mastery, teachers develop tests and administer them in a pretest-post test sequence based on the unit of study. Tutoring occurs simultaneously for all tutor-tutee pairs involving the entire class at the same time. This leaves the teacher free to monitor and provide positive feedback during the students' tutoring

session.

Random pairing of students is not recommended culturally and linguistically, diverse learners with no or limited English skills, one student in each pair serves as the tutor or teacher for 10 minutes, while the other student is the tutee. After 10 minutes have expired (signal by a timer), the tutoring pairs reverse roles for an equivalent amount of time. Tutoring content lists or study guides consist of material briefly introduced or not previously covered by the teacher. (Like new list of mathematics fact, definition on now concepts) enable the teacher to introduce a lesson to the whole class. While the students are tutoring, the teacher moves about the classroom and award them " bonus points" for appropriate tutoring behaviours, such as clear presentation of materials, correct use of the error correction procedures and positive comments to reinforce the tutoring partner. Immediately after the tutoring session, students' total daily points are recorded on a laminated team points chart posted in front of the classroom. This provides another opportunity for the teacher to verbally reinforce students for their daily progress by evaluating their previous day's performance. Each day, a team is announced as the daily winner. Students clap to congratulate the winner and move to the next class period. Tutoring sessions typically occur 4 to 5 days during the week, 30 minutes each for mathematics. At the end of the week, students' progress is assessed with a teacher-prepared test covering the same material of the tutoring during the week. Some teachers choose to tutor 4 days and allocate Friday as a testing day. Students take test individually and earn 5 to 10 tutoring points for each correct answer. These points are also recorded on the team points charts.

Culture of the Mathematics Classroom

Multiple studies of the culture of the mathematics classroom have concluded that the student's role and actions depend primarily on the view of mathematics "projected" by the teacher research. "The Linearity and formality associated with most teaching of mathematics from published schemes or text-books tend to produce a passive acceptance of mathematics in the abstract, with little connection being made by pupils between their work and real life. Pupils accept the visibility of mathematics in terms of a "right or wrong" nature and their main concerns seem to be with the quantity of mathematics done and its correctness. When beliefs about mathematics differ and where views of mathematics as socially constructed knowledge prevail, pupils take on quite a different role. The messages they receive are that they are expected to contribute their own ideas, to try their own -solutions, and even to challenge the teacher.

According to Harper (1990), teachers with "an integrated, conceptual understanding" of mathematics tend to organize their classrooms activities that encourage students to engage and . interact with the conceptual aspects of mathematics. Furthermore, the depth of mathematics taught correlates highly with the depth of the teachers' mathematical knowledge. A crucial role of the teacher is to structure "a pervasive norm in the classroom that helping one's peer to learn is not a marginal activity, but is a central element of students' role" (Slavin, 1985). In a review of 8 research studies on '. grouping in mathematics classroom. Davidson (1985) concluded that, students working in small* groups significantly outscored students working individually. Thomas (1992) argued that, solving a mathematics problem in small groups' exhibit cognitive behaviours and processes that are essentially" similar to those of expert mathematical problem solver. Learning mathematics in co-operative groups is effective, especially for younger students.

In their research, Bergeson (2000), concluded on the effect of co-operative learning in mathematics classroom as follow:

(1) Students with different ability levels become more involved in task-related interactions,
(2) Students' attitudes toward school and mathematics become more positive.
(3) Students often improve their problem solving abilities.
(4) Students develop better mathematical understanding.

Teachers can maximize mathematical learning in a small group environment by engaging students in learning activities that promotes "questioning, elaboration, and other verbalizations in which they can express their idea and through which the group members can give and receive feedback" (Slavin, 1989).

Students solving mathematical problems in small groups involve three features that enhance the individual student's cognitive re-organization of mathematics, (i) The student experiences "challenge and disbelief on the part of the other members of the group,

which forces then to examine their own beliefs and strategies closely, (ii) The group collectively

provides background information, skills and connections that a student may not have had or understood, (hi)The students might internalize some of the group's problem solving approaches and make them part of their personal approach,

Teachers trying to build and sustain mathematical discourse among students need to create an environment in which students build a "personal relationship" with mathematics. Three key elements need to be in this environment:

(a) Students need to engage in authentic mathematical inquiries
(b) Students must act like mathematicians as they explore ideas and concepts.
(c) Students need to negotiate the meaning of, and the connections among these mathematics ideas with other students in the class.

Recommendations

The Federal Government through the Ministry of Education should be involved in the following:

(i) A potential peer tutor should possess leadership skills, be responsible, positive and be able to accommodate the interest of other students.
(ii) Skilled tutors who are capable of assessing tutors' knowledge be employed,
(iii) Students should find motivation to learn in helping others and gain a sense of responsibility for their learning,
(iv) Various peer tutoring and cross-age tutoring be implemented to boost academic performance, improve self-concept and decrease the likelihood of dropping out.

Conclusion

Peer tutoring is the process by which a competent pupil with minimal training and with a teacher's guidance, help one or more students at the same grade level learn a skill or concept in mathematics. Peer tutoring when applied to the teaching and learning of mathematics, utilizes a strategy in which students can provide extensive help to each other. For example, one-on-one tutoring provides favourable conditions for a student to become active, self-regulated learning methods. Peer tutoring provides an environment that foster students to be inquisitive, self-motivated, and in charge of rectifying their own knowledge deficits.

In the peer tutoring approach, the tutor is responsible for rectifying the student error, diagnosing the cause of the error and shepherding the student through a correct solution path. The design of a peer tutoring program, is governed by its goals, included in these goals are age group targeted, subject to area to be studied, and by availability of human, physical and financial resources. Setting specific goals in peer tutoring are important so that individual progress can be measured and examined.

Peer tutoring provides three essential benefits that are common in a good teaching strategy. These three noted benefits of peer tutoring are: the learning of academic skills, the development of social behaviours and classroom discipline and the enhancement of peer relations.

The paper therefore concludes that peer tutoring works as a teaching strategy to enhance the teaching and learning of mathematics in secondary schools.

References

Bergeson, T. (2000). Teaching and Learning Mathematics. Available on website (ww.K12.Wa.Us).

Damon, W. & Phelps, E. (1989). Strategic uses of Peer Learning in children's Education. New York: John Wiley and Sons.

Danon, W. & Phelps, E. (1988). Three approaches of Peer Learning and their Educational uses. Paper presented at the annual meeting of the American Educational Research Association, New Orleans.

Fantuzzo, J.; Polite, K.; and Grayson, N. (1990). An Evaluation of Reciprocal Peer tutoring across Elementary School Setting. Journal of School Psychology 28 (Winter). 309 -23.

Gaustud, J. (1993). Peer and Cross age tutoring. Eric Digest 79. University of Oregon,

Available:htt://eric .oregon.edu/publications/digcsts 079.html.

Greenwood, C.R.; Carta, J.J.; and Hall, V. (1995). Class wide Peer Tutoring: Effective teaching and • Research Review. New York: Academic Press.

Harper, G.F. (1990). Responsive Research: Application of Peer tutoring to Arithmetic and spelling. Direct Instruction, Direction Instruction News 9, 34-38

Harper, G.F. (1999). Peer Tutoring and the minority child with disabilities: Preventing school. New York: John Wiley and Sons.

Harris, R. (1991). Valued Youth Program Dropout Prevention Strategies for At-Risk Students. A Paper presented at the annual meeting of the American Education Research Association Chicago.

Hartman, H.J. (1997). Tutoring Intelligently, Learning and Instructions (PP 102 - 124) City College of City University of New York. 0' Donnell, A. M. (1999). Cognitive perspectives on Peer Learning.
Mahwah, New Jersey: Lawrence
Erlbanm Associates.

Slavin, R. E. (2002). Effect of students' teams and Peer tutoring on Academic Achievement and Time on-Task. Retrieve from Lbtt://www.edigov/databases/Eric Digest/ed 350598html
Topping, K. (1988). The Peer Tutoring Handbook: Promoting Cooperative Learning. Cambridge, M.A: J3rookline Books.

Topping, K. (1998). The Effectiveness of Peer Tutoring in further and higher education: A typology and review of Literature. London: Kogan Press.

Thomas, R.L. (2000). Cross-age and Peer Tutoring. Available: htt://www.ed.gov/databases/Eric. Digested 350598: html.

Wagner, L. (1990). Social and Historical Perspectives on Peer Tutoring and Education. New York: John Wiley and Sons.