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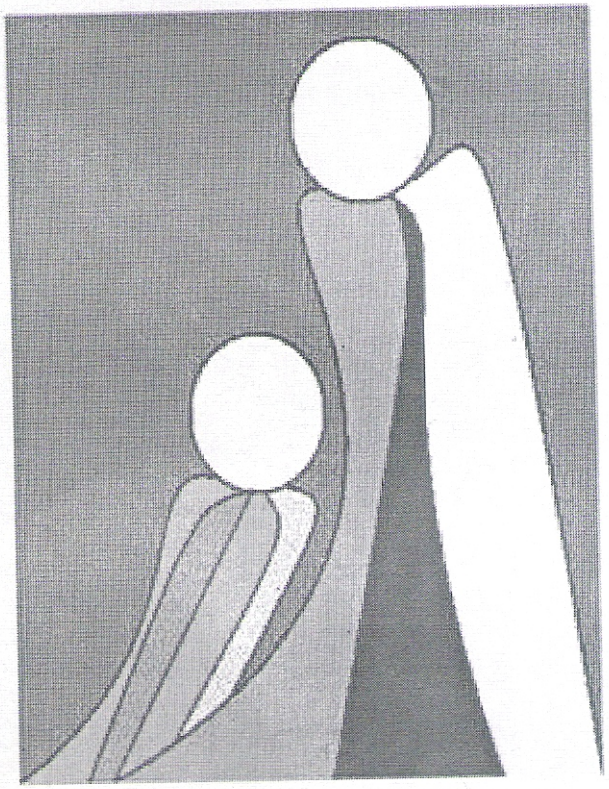

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Effect of Self-Regulated Learning (SRL) and Conventional Strategies on Students' performance in Mathematics

Adetunji Abiola OLAOYE (Ph. D)
Department of Science & Technology Education
Lagos State University, Ojo, Nigeria

Abstract

The paper examined the effect of Self-Regulated Learning (SRL) and Conventional Strategies on students' performance in mathematics. As an empirical study, 150 senior secondary school one (SS1) were drawn via purposive random sampling procedure from ten schools out of the existing sixty public schools in Badagry Area of Lagos State. One broad hypotheses was raised in the study, and instruments used included achievement test in mathematics($r = 0.74$) and SRL strategy manual guide ($r = 0.65$). Data were analysed through One-way ANOVA. Findings indicated that there was significant difference in the academic performance of students in Mathematics of those on self-regulated (F-cal>F-ratio, df={1, 49}; P<0.05) and the conventional groups(F-cal>F-ratio, df={1, 49}; P<0.05) performed better than those in the conventional cum self-regulated group(F-cal<F-ratio, df={1, 49}; P>0.05); and teacher seemed to be knowledge inhibitor instead of knowledge facilitator. The implication of the findings was further enumerated in the paper.

Key words: Self-regulated, Strategies, Performance, Conventional, Secondary Mathematics

Introduction

The role which Mathematics plays towards realization the nation's scientific and technological aspiration is unquestionable. In the words of Jegede (1984), the importance of mathematics education in Nigeria's educational system and the nation's technological development has been recognized. Agreeing with Jegede, Ezeilo (1989) noted that there could be no development technologically without a corresponding development in mathematics both as conceived and practiced. Zekele (2001) points out that education system throughout the world place importance in the teaching and learning of mathematics and lot of resources are allocated to maintain and improve efficiency in these activities. He stated that a good background in mathematics presented opportunities in the selection of fields of study at college which in most cases required the learners to present evidence that they have a credit level in mathematics in any discipline of their choice to enhance career formation. According to Ablard, Mills and Shumpt (1993) mathematics is important because its study is associated with more academic and career opportunities. In this regard, mathematics acts as a critical "filter" for entry into the higher education programme and even for the world of works (Ernest, 1994). This explains why mathematics is given much attention and real focus in the school curricula. For example, the international Association for Evaluation of Educational Achievement (I.E.A) estimated that most systems in the world devote at least one fifth of the learner's time to the study of mathematics.

Many efforts have been put up to improve the level of learning of mathematics in our society. Among these are the formulation of mathematics curricula in harmony with the national objectives and philosophy of the education and formulation of objectives for teaching mathematics, which Obioma (1993) identified as:

(i)Developing accurate, logical and abstract thinking in the learner, (ii) Development of computational skill, (iii) Discovering and appreciating the beauty of mathematics; and (iv) Demonstrating the applicability of mathematics in various fields.

To this end curriculum organizations such as Mathematics Association of Nigeria (M.A.N), Science Teachers Association of Nigeria (STAN) and a host of others have continued to make concerted efforts to popularize mathematics. In the words of Emenalo (1994), the objectives in establishing the Mathematical Association of

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Nigeria in 1961 was to eliminate innumeracy in Nigeria. The establishment of a Mathematical Centre in Abuja is also a pointer to the prominent attention given to mathematics (Abdulahi, 1993). Annual mathematics competitions for different stages of primary and secondary school pupils titled "Mathematics Olympiad" as often organized by the mathematical centre is a remarkable step to identify and motivate young talents in mathematics. The importance placed on mathematics is reflected in the way parents and guardian show concern in their wards performance in mathematics, whereby they cannot afford to pay extra lessons in any other subject, they often strive to pay for extra lessons in mathematics (Graham-Brown, 1996). In spite of all the aforementioned, it is disheartened to observe that the same subject continually recorded dismal students' performance as corroborated by Odubunmi (2006) when presented the West African School Certificate result as shown in table 1 below:

Table 1: Students' performance in Mathematics from 1991-2004 in the WASCE

Year	Number of candidates	% of Credit pass	% of failures
1991	294,079	11.10	88.90
1992	265,491	21.69	78.31
1993	291,755	10.93	89.07
1994	518,118	16.50	83.50
1995	262,273	16.50	83.50
1996	514,342	10.00	90.00
1997	616,923	7.60	92.40
1998	756,080	11.15	88.75
1999	756,080	18.25	81.75
2000	643,371	32.81	67.19
2001	NA	36.55	63.44
2002	1,078,961	31.56	68.44
2003	939,506	36.91	63.09
2004	844,525	34.52	65.48

Source: West African Examination Council Annual reports in Odubunmi (2006)

A critical analyses of the above table reveal that all is not yet well with the students' performance in mathematics when looking at the role it supposes to play towards technological development on one hand, and the premium emphasis placed on its teaching and learning in the school system. As a result, different possible causes of students' dismal performance in mathematics have been advanced by different scholars among which included teachers' related factor, students' and parental' s factor just to mention a few. Out of these studies have not extensively talked about the strategy under which students learn the subject, as two teachers cannot claimed to use the same strategy as effectively as other save the students' performance is used as yardstick of whomever that performed better. It is on this note that the present study tried to examine the effect of the Self-Regulatory Learning (SRL) strategy on students' performance in mathematics.

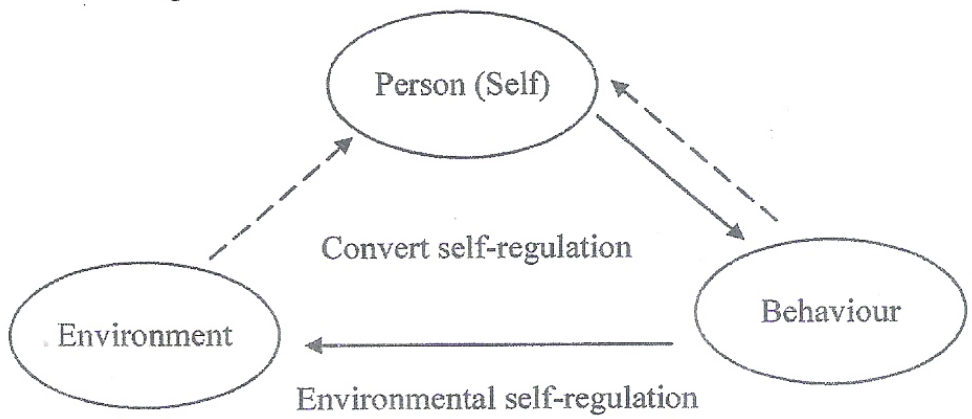
Theoretical Framework on Self-Regulatory Learning (SRL)

Self-regulatory learning refers to students' ability to control their learning as learners become self-regulated using both knowledge and strategies referred to as skills. The motivational desire to use these skills is referred to as will (Pendley, 1994). Kohl and Kraska (1994) see self-regulatory learning as the ability to behave according to one's own intuition with respect to learning. According to them, it means that learners self-regulate, design an intention of learning, plan the strategies of execution and actualized their planning. Researchers have found out that this learning strategy is viable for excellent academic achievement (Butter and Winnie, 1995), but in contrast, this area of research has not been popularized in Nigeria, hence the need to include self-regulatory learning. Self-regulation according to Schunk & Zimmerman (1994) refers to students' ability to understand and control their learning.

With respect to learning, self-regulation bridges two of its determinants, namely cognitive ability and achievements motivation. Zimmerman (1990) who had worked extensively on self-regulatory learning described self-regulatory as students can be described as self-regulated to the degree that they are meta-cognitively, motivationally and behaviourally active participants in their own learning process, and such students personally imitate and direct their own efforts to acquire knowledge and skill rather than relying on teachers, parents or other agents of instruction. They identified learning concepts associated with self-regulatory learning as self-reinforcement, standard setting, self-efficacy, perceptions, self-instructions and self-evaluation.

Butler and Winnie (1995) describe self-regulation learning as a style of activities for problem solving that includes evaluating goals, thinking of strategies and choosing the most appropriate strategy for solving a problem. It is one area of learning earlier termed as "learning how to learn" Flechsg (1980). The historical background of self-regulation is linked with earlier works on "learning how to learn".

In the contemporary, researchers have suggested that explicit instruction in self-regulation procedures is critical to effective strategy deployment, production of new meta-strategy information, independent strategy use, maintenance and generalisation (Pressely & Woloshyn, 1995). Such procedures have been noted to have improved children's self-efficacy (Bandura & Schunk, 1981). Social cognitive dimension viewed self-regulation in learning as a certain "triadic" process, which occurs in a reciprocal manner. On the other hand, social-cognitive theorists perceived self-regulated as personal processes that determine learning activities. These processes are assumed to be influenced by environmental and behavioural events in reciprocal manner as it is represented in figure 1 below.



A Triadic model view of self-regulated learning.

The figure explains that a students' proactive use of an environmental manipulation strategy, e.g. arranging a quiet study area for computing school work at home involves an intervening behaviour sequence of room-altering responses, arranging adequate lighting and a place to write. The continued use of this structured setting for learning depends on perceptions of its effectiveness in assisting learning. This convey a reciprocal through an environmental feedback loop. Zimmermann (1989) deduced that social-cognitive theorists assumed that self-regulation involves three classes of sub-processes namely self-observation, self-judgement and self-reactions.

Researches however have identified common self-regulated learning that students used to improve their academic achievement, and as categoried into *(i)Self-evaluation, (ii)Organising and transforming,(iii)Goal setting and planning,(v)Seeking information,(vi)Keeping records, (vii)Environmental structuring, (viii)Self-*

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cons equating, (ix)Releasing and memorising, (x)Seeking social assistance, (xi)Reviewing records and (xii)Initiations from others

One model of self-regulation that accounts for students' active control of their on-going effort has been proposed by Kuhl (1984, 1985, 1992) and had been further explained by Cornio (1989) and Cornio & Kanfer, (1993). In this model, students work to maintain their pursuit of a goal, once it has been chosen through a variety of volitional strategies. Cornio (1989) saw volition as concerns with those processes which involves maintaning an intention of goal until it is fulfilled, and it is distinct from motivation that pertains only to those processes that involved in the initial creation of an intention or goal. The process involved in establishing an intention as motivational, whereas the process involved in sustaining that intention until they are fulfilled are volitional.

They review by Winnie (1997) on self-regulation learning (SRL) indicates three observations. First, SRL is not deliberate,complex and meta-cognitive like other skills as "SRL" reaches a level of expertise at which it is enacted in automatic and simple forms. Secondly, SRL is grounded in expression of deeply seated knowledge, skills and beliefs integrated over an idiosyncratic history with learning experience. Third, young students have not yet developed robust meta-memory acquisition as characterised in self-regulation. It is the duty of educational system and programme to teach and monitor the use of such meta-cognitve strategies in learning. Winnie (1997) posited further that students lack explicit information about SRL or receive a little of it as some of what they learn/gained is by observing others. He noted that there scarcities of students who modelled effective form of self-regulated learning and therefore believes that sort of instruction about forms of SRL should be taught.

In this model of self-regulatory learning, he explains that students knowledge of self-regulation are in a trial-and-error fashion. In such case, students recognise when obstacle blocks progress by different tactic for learning and observe results.

The second shape of trial-and-error investigation involves recursive planning. Errors are perceived as information which is used to revise prior beliefs and to design future trials. This may field programme results as they engage in serially interruptive decision making and reflective cognition (Butler & Winnie, 1995). After a task has been interpreted in terms of what students know and believe, the model suggests that the frame goals, select tactics or strategy that predict how they reach those goals be applied with those methods and observe what results arrived at. By monitoring the match between the attributes of those results and the standards that described what they intended to produce, students internally generates information that is fed back into the process. Students may also monitor attributes of monitoring themselves and generate information on adopting that process of monitoring. Output generated in a prior cycle of cognition into subsequent cycles of engagement is what makes SRL recursive.

The obvious deductions from all these assertions are self-regulation learning could be self-developed and taught by teachers, taking students personal and social inclination into consideration. This seems to suggest that studies self-regulation could be approached in a multi-dimensional way. This informed the line this present study has taken in examining the initial self-regulatory antecedents of the students (self-regulatory learning level) and the effect of self-regulatory learning guidance given to aid students learning.

Statement of the Problem

The study was designed to examine the effects of self-regulatory learning and conventional strategies on student's performance in mathematics.

Research Hypotheses

Ho_{1a}: There is no significant difference in the performance of mathematics students that were exposed to Conventional, SRL and (SRL + Conventional) methods.

Ho_{1b}: There is no significant gender difference in the performance of mathematics students that were exposed to Conventional, SRL and (SRL + Conventional) methods.

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Ho_{1c}: There is no significant effect of Conventional methods on the performance of mathematics students that were exposed to Conventional and SRL methods.

Methodology

Research Design

The study is an empirical study that examined the effects of self-regulatory learning and conventional strategies on student's performance in mathematics. Variables in the study include learning strategies, gender and performance in mathematics.

Population

The target population for the study consisted of Senior Secondary I (SS1) students in Badagry Area District 5 of Lagos State.

Sample and Sampling Procedure

Three schools were selected through stratified random sampling with 150 students selected through simple random sampling for the study. Conventional group had 50 students, SRL group had 50 and (SRL + Conventional group) had 50 students.

Research Instruments

The study made use of Mathematics Achievement Test (MAT) and Self-Regulated Learning (SRL) strategy manual.

Validation of Instruments

Content validity indicates the degree to which the test items measure what the test is designed to measure. Meanwhile, the instruments were designed by the researcher and submitted for scrutiny to an experts to check how related the test items were to the aims and objectives of the study. These instruments were thereafter trial-tested on similar groups of students and mathematics teachers that were not included in the major study. The interval of administering these instruments was such that they ensure that respondents were able to correct the ambiguities which researcher expunged towards a final draft, which were used for the study.

Reliability of Instruments

Reliability of instruments refers to consistently to which instruments measure what they were set to measure. To ascertain the reliability of the achievement test, they were administered to SS1 students in one public secondary school as earlier reported within interval of weeks and their responses were correlated using the Cronbach Alpha formula with values of 0.74 and 0.65 for the achievement test and Self-Regulated Learning (SRL) strategy manual respectively.

Procedure of Administration

Prior to the administration of the achievement test, an attitudinal questionnaire was administered to all the students via their mathematics teachers to establish the extent to which they were disposed to the subject. After this was the administration of pre-test in mathematics before separation into three groups namely Conventional, SRL, and (SRL + Conventional) groups. The SRL and (SRL + Conventional) groups were exposed to the same mathematics contents of SS One for consecutive four weeks with the first week used to train their mathematics teachers on how to make use of the SRL manual at variance depending on the group handled. On the other hand the Conventional group was left with their mathematics teacher to teach the same content of mathematics as that of SRL group, but not brief on the rationale behind the teaching of those content areas. The last sixth week was used to conduct the post-test for all the students in the study, as the whole exercise lasted six weeks.

Data Coding and Analysis

In view of the fact that this study was quasi-experimental, different methods of data analysis were employed. The data collected during the administration of the instrument were collated and analyzed using one way ANOVA at 0.05.

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Findings

Ho_{1a}: There is no significant difference in the performance of mathematics students that were exposed to Conventional, SRL and (SRL + Conventional) methods.

Ho_{1b}: There is no significant gender difference in the performance of mathematics students that were exposed to Conventional, SRL and (SRL + Conventional) methods.

Ho_{1c}: There is no significant effect of Conventional methods on the performance of mathematics students that were exposed to Conventional and SRL methods.

Table 2: ANOVA of strategies' employed on students' performance in Mathematics

Strategies	Tests	Variations	SS	MS	df	F-cal	F-ratio	Significant
Conventional	Pre-test	Between	137.78	137.78	1	10.68	2.08	P<0.05*
		Within	619.20	12.9	48			
		Total	756.98		49			
	Post test	Between	131.22	131.22	1	6.94		P<0.05*
		Within	907.20	18.9	48			
		Total	1038.42		49			
Self-Regulated	Pre-test	Between	246.42	246.42	1	5.81		P<0.05*
		Within	2036.8	42.43	48			
		Total	2283.22		49			
	Post test	Between	196.02	196.02	1	13.12		P<0.05*
		Within	716.96	14.94	48			
		Total	912.98		49			
Conventional & Self-Regulated	Pre-test	Between	2.42	2.42	1	0.16		P>0.05
		Within	744.08	15.50	48			
		Total	746.50		49			
	Post test	Between	23.12	23.12	1	0.51		P>0.05
		Within	2170.00	45.21	48			
		Total	2193.12		49			

*Significance

Table 2 described one way ANOVA of strategies' employed on students' performance in Mathematics at the pre-test and post-test levels with three distinct groups of students namely the conventional, Self-Regulated and conventional cum self-regulated groups so that gender was taken as intervene variable in all cases. At the pre-test levels results indicated that there was significant difference in the academic performance of students in Mathematics. By implication those on the self-regulated ($F\text{-cal}>F\text{-ratio}$, df={1, 49}; $P<0.05$) and the conventional groups($F\text{-cal}>F\text{-ratio}$, df={1, 49}; $P<0.05$) performed better than those in the conventional cum self-regulated group($F\text{-cal}<F\text{-ratio}$, df={1, 49}; $P>0.05$).

At the post-test level study indicated that there were significant difference in the students' performance in Mathematics of the conventional ($F\text{-cal}>F\text{-ratio}$, df={1, 49}; $P<0.05$) and self-regulated groups ($F\text{-cal}>F\text{-ratio}$, df={1, 49}; $P<0.05$), when in real sense there was no significant difference in the performance of students in the conventional cum self-regulated group ($F\text{-cal}<F\text{-ratio}$, df={1, 49}; $P>0.05$).

Discussion of the findings

The interesting implication of the study lies in the fact that those in the conventional group seemed to be good in Mathematics on one hand even though their counterpart in the self-regulated group was quite better than them. Apart From this it was discovered that rather than contributing to the performance of students in the conventional cum regulated group teacher's presence seemed to be a hindrance to the academic performance of these students.

This is a pointer to the fact that students could learn better when they were given freedom to discover things for themselves. Also, the methodology employed by the teacher could send a threat to the students to cope with the rigour of better knowledge assimilation.

Conclusion

It provides empirical information that may enhance the training and re-training of teachers with basis for counselling students and teachers on viable approaches and aids for fruitful learning. It provides a framework for policy makers and educational administrators in curriculum development, process and implementation. And finally, based on the findings of the study, educators and researchers will also benefit from the expanding literature. It is better stated that role of teacher is becoming pronounced to be knowledge facilitator as against knowledge dispenser when they ought to realized that as soon as there is no problem in education to solve ends their own source of livelihood. This implies that every mathematics teacher needs to come to realize that teaching as she was prepared was no longer relevant but innovation is imperative. Mathematics has to update that pedagogy knowledge and adapt it to teaching of the content areas of mathematics otherwise the mathematics classroom will one day become a graveyard for the nation, and not that the subject is as tough as that but its implementation make it dreadful.

Recommendation

As a result of the finding subsequent study should be done in well pronounced rural areas where bulk of students could be found with these strategies tried out. Apart from this, the same study could be conducted at the lower level of education to authenticate the real problem facing the learning of mathematics, as the foundation determines the interest of students to pursue mathematics further in life. Similar study could be extended to different subjects where students' dismal performance has been continuously discovered to be main feature of the end result.

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