

Effects of Reflective Teaching strategy on Students' Academic Performance in Secondary School Physics in Ekiti State, Nigeria

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Abstract: The study examined the Effects of Reflective teaching strategy on Students' Academic Performance in Secondary School Physics in Ekiti State, Nigeria. It also examined the effect of Reflective teaching strategy on gender of Physics secondary school students. The study employed the quasi-experimental pretest – posttest control group design. The subjects were randomly assigned to two groups (Experimental and control group). Fifty students were assigned to each of the experimental and control groups respectively. The sample for this study comprised four senior secondary 1 (SS 1) Physics teachers and all Physics students on ground in 4 schools (2 schools for experimental and 2 schools for control group) senior secondary Class 1 students. The sample was selected using multistage sampling technique. The first stage was the selection of 4 schools out of 12 available public senior secondary schools in Ekiti West local government area, using simple random sampling technique. The second stage was the selection of 25 physics students (15 male and 10 female) from each of the four selected schools using stratified random sampling. (to give a total of 100 students). The participants were randomly assigned to the experimental and control groups respectively (two schools each per group). The instrument used to collect data was Physics Achievement Test (PAT). The reliability coefficient of the instrument was 0.87. The Instrument was administered on the subjects before and after the treatment. The data generated were subjected to t-test analysis, analysis of variance and analysis of covariance to test for the acceptance or rejection of the null hypotheses at 0.05 level of significance. Results of the analyses showed that Reflective teaching strategy produced better achievement in students. Based on the findings of the study, conclusions and recommendations were made.

Keywords: Reflective, teaching, Reflective teaching, academic performance, secondary school.

Introduction

The teaching-learning process is as old as human being on the earth. It has been carried out by human beings and even by animals, to teach their young ones for successful adjustment to existing conditions in their environments (Owoeye, 2017). Teaching as conventionally understood by the traditional teacher, is just the act of disseminating information to learners in the classroom. Similarly, Filani (2010) cited in Boris (2019) defines teaching as systematic process of imparting desirable knowledge, values and skills to learners.

A teacher with training is more mature and confident to perform his task more efficiently. The quality of our human capital depends on the quality of our teachers. What students learn is directly related to what, and how teachers teach, and what, and how teachers teach depends on their knowledge, skills and commitments. Conventional teaching is simply chalk-talk approach in which students remain passive as learners. Instruction is not properly organized and rote learning is heavily emphasized. Mostly, the results of the students are not satisfactory due to the use of this approach. Nwagbo (2007) cited in Boris (2016) affirms Instruction in science is aimed at achieving two goals: the first is the acquisition of the body of organized knowledge in a particular domain, and the second important goal in science instruction is the ability to solve problems in that domain.

Boris (2019) opines that a teacher may profess to hold fifteen years' experience, but the experience means nothing if he keeps on repeating the same thing without bringing innovation into his teaching. The winning edge comes when teachers do not rest on their past laurels but gear themselves up to impart innovative and intellectually challenging education, link their discipline with contemporaneous issues of global import, provide illustrations from life and promote constructive rethinking rather than rote learning, so that the students can be competent, confident and conscientious in a complex and competitive future. If the child is not properly and adequately trained and educated, the nation might find it difficult to attain the set developmental goals, hence her hope on learning for scientific and technological development will be defeated.

The curriculum must be properly implemented in order to bring about the desired goals. For a curriculum to be properly implemented, appropriate instructional tools, method, learners' interest and attitude towards the teaching and learning of desired subjects must be properly taken into consideration. Hence, greater importance on the strategies, styles and methods of teaching, particularly one that can motivate the learner and bring desired learning outcomes should be employed.

The need to improve the quality of science teaching and learning for citizens so that they develop scientific literacy to cope with the demands of science and technology growth has been the yearning of every nation in the 21st century. Adediwura & Bada (2007), Ehindero & Ajibade (2000) supports good methods of teaching that would make the learners develop and have sound education.

Physics is among the three major pillars of science (i.e. Physics, Chemistry and Biology). The importance of Physics for the development of a nation is, therefore, glaring. Physics is the most basic of the sciences and its concepts and techniques underpin

the understanding of other disciplines: A thorough understanding of mechanics is necessary to the chemists and the material scientists since the structure of every atom in the universe is determined by mechanics.

Macmillan (2012) cited in Awodun (2015) that Physics is also a cross-cutting discipline that has applications in many sectors of economic development, including health, agriculture, water energy and information technology. There is no doubt that a good part of the scientific knowledge is derived from the principles of Physics. Indeed, the knowledge of Physics has led to so many inventions such as the production, application and utilization of integrated circuits, production and use of machines and other contrivances. It also accounts for the discovery and production of hydroelectric power, gas turbine and thermonuclear power plant, telephones, refrigerators, heaters and gas/electric cookers. Physics is an important science subject that makes immense academic demands on students in its learning.

Boris (2016) cited Ali (2015) that a number of factors have been identified as militating against students' attainment of the objectives of science instruction, and the most pronounced factor identified by researchers is the inappropriate and uninspiring teaching methods adopted by science teachers. According to Ogunleye & Babajide (2011), Nigeria has witnessed persistent poor students' performance in Physics at the senior school certificate level. This has been linked to the adoption of instructional strategies which did not give enough consideration to learners' previous knowledge and how they reasoned in order for learners to construct their knowledge based on these. Similarly, Achufusi (2015) cited in Boris (2019) that the ignorance of teachers and neglect of activity oriented methods by teachers grossly contributed to students' low performance in Physics.

It is imperative to create room for further search for instructional tool that could appeal and arouse learners' interest and at the same time help to achieve the objectives of science education. Therefore, this study intends to examine the effects of Reflective Teaching Strategy on Students' academic Performance in Secondary School Physics in Ekiti State, Nigeria.

To achieve the desired educational goals, teachers need to reflect on their teaching from the planning stage to the last process of their teaching in the classroom. This process will, according to Clarke (2003), allow the teachers to clarify their knowledge base, content and their students' learning styles and as well, crystallize the pedagogy to be implemented.

Methodology is very vital in any teaching- learning situation. The method adopted by the teacher may promote or hinder learning. It may sharpen mental activities which are the basis of social power or may discourage initiatives and curiosity, thus making self reliance and survival difficult. (Ameh & Dantani, 2012). Teaching is not just standing in front of a class talking. The best teachers contemplate the manner in which they all present a topic and have a wide variety of instructional strategies at their disposal.

Reflective teaching orientates teachers towards self-focus and self-evaluation. It involves the transformation of professional values and actions of the teachers and that of others who he/she interact with. Reflective teaching means looking at what you do in the classroom, thinking about why you do it and thinking about if it works or not. It is a process of self-observation and self-evaluation in which strength and weaknesses are identified and then adjust to re-plan for better performance. It is a means of professional development which begins in the classroom. It is paying critical attention to the practical values and theories which inform everyday action by examining practice relatively and reflexively, (Bolton, 2010). Reflective teaching is in three phases: planning, teaching and debriefing.

Gatumu (2006) opines that reflective teaching has to do with deliberate examination of how we teach and learn. It is more towards critical thinking of how we teach and learn. It is a kind of teaching strategy which has to be viewed in terms of what the teacher can do for himself and his students to ascertain productivity in his teaching and in his students' learning. Hence reflective teaching is a call to let the teacher combine theory and practice to maintain and sustain his teaching profession (Ige & Olayode, 2012).

Reflective teaching is also about a skilled teaching of knowing what to do. In this manner reflective teaching is a professional alternative to action research. It is a personal means of conducting one's own ongoing professional life by solving problems in a systematic manner (Gatumu, 2006). Pollard (2006) regards reflective teaching as a cyclic process by which teacher interprets his/her classroom practice. Reflective teaching enables teacher to form the known to the unknown by making use of recalled experiences in a critical manner. Reflective teaching is a deliberate move to allow the teacher think critically of his/her teaching, so that his/her students can maximise their learning. Reflective teaching is a mark of a concerned teacher who is skilled enough to examine his/her beliefs, values and assumptions behind the teaching practice (Ige & Olayode, 2012).

Atkins, Murphy & Schon as cited in Gibbs (2004) describes modes of reflection by taking into account the time in which they occurred. They described the reflection that takes place during the action as "reflective in action" and the reflection occurring after the action as "reflection on action". These two types of reflection has been the source of identification of different kinds and levels of reflection.

Developing effective teachers has become one of the basic underlying principles of all teacher education courses and reflective teaching as an essential factor for the enhancement of the development of effective teachers. Harrison (2005) argues that it is more meaningful to promote reflective teaching among experienced teachers than novice teachers because experienced teachers are more intuitive whereas novice teachers take every step by careful consideration and deliberation. The skill of reflective teaching develops highly over time and this can be observed easily among the experienced teachers. Reflective teaching is used at both pre-service and in-service levels of teaching, although coaching and peer involvements are the two aspects of reflective teaching seen most often at the pre-service level.

Navaneethan, (2006) opines that, reflective teaching involves recognizing, examining and ruminating over the way an individual teaches. As individuals possess their own background and experience, they bring certain beliefs, assumptions, knowledge, attitudes and values to teaching. A teacher finds his/her initial teaching effort stressful, but with experience he/she acquires a repertoire of teaching strategies that he/she draws on throughout his/her teaching, and this invariably constitutes his or her teaching style.

Jasper (2003) in Boris (2016) associates continuous reflective teaching with lifelong learning resulting in the development of autonomous, qualified and self directed professionals. Bartlett cited in Navaneedhan (2006) points out that becoming a reflective teacher involves moving beyond a primary concern with instructional techniques and how to question as well as asking 'what' and 'why' questions that regard instructions and managerial techniques, not as ends in themselves, but as part of broader education purposes. Asking the questions, 'what and why' gives certain power over individual's teaching, resulting in the emergence of autonomy and responsibility in the work of teachers in reflecting on the above kind of questions, teachers begin to exercise control and open up the possibility of transforming every day classroom life.

Navaneedhan (2006) emphasizes that research on reflective teaching over the past two decades has shown that, It is linked to inquiry and continuous professional growth. Reflective teaching can be a beneficial form of professional development at both the pre service and in-service levels of teaching. It develops critical thinking and promotes experimental learning. It enhances personal growth. It gives freedom to teachers to impose their own methodology enhancing rational thinking.

Boris (2016) cited Thompson (2011) that by engaging in reflective teaching, teachers show a capacity (or disposition) to analyze the process of what they are doing and to reconstruct their professional and personal knowledge schemes, while simultaneously making a judgment to adapt their practice to best match the needs of students.

Reflective teaching involves critical examination of our motivation, thinking and practice, this leads Narvaez (2010) to described reflective teaching as an interpersonal experience leading to insight about ourselves as actors in our worlds.

Kullman in Ogonor & Badmus (2006) says a major focus of reflective teaching is personal growth. The reflective process involves continuous self observation and evaluation of the trainee to understand individual actions and the reactions of learners. The process was conceptualized as an action research model whereby people learn and create knowledge by critically reflecting upon their own action and experiences, forming abstract concepts and testing the implications of these concepts in new situations. The value of engaging in reflective activity is enhanced if it is carried out in association with the colleagues, they may be trainees, teaching assistants, teachers or tutors (Pollard, 2006). Reflective teachers are likely to benefit from working together, experimenting, talking and reflecting with others. Apart from the benefits for learning and professional development, it is usually more interesting and more fun.

The ability of a teacher to reflect on his/her teaching is an important element of any successful teacher education programme. Efe (2011) investigates science student-teacher attitude about reflective practice and found that science student-teacher's attitudes toward reflective practice change in relation to the subjects and years of study.

Ojanen (2002) studied how student -teachers develop the skills necessary for reflective teaching during their field experiences. He explored the role of the teacher educator as coach and found out that teacher educators can most effectively coach student teachers in reflective teaching by using students' personal histories, dialogue, journals, as well as small and large group discussions about their experience to help them reflect upon, and improve their teaching.

Kettle & Stellars (2000) studied the development of third-year teaching students'; they analyzed the students' reflective writings and interviewed them extensively about their reflective practices. They found that the use of peer reflective groups encouraged student teachers to challenge existing theories and their own preconceived views of teaching while modelling for them a collaborative style of professional development that would be useful throughout their teaching carriers.

Navaneedhan (2006) studied reflective teaching pedagogy as innovative approach in teacher education through open and distance learning. The result was found to be favourable as it reflected on better academic performance of the students in whose class the reflective teaching-learning pedagogy was practiced.

Ogonor & Badmus (2006) on the other hand studied Reflective teaching practice among student teachers in a tertiary institution in Nigeria. The findings from this study indicated that student- teachers were elated and had opportunities for professional growth as they practice reflective teaching. However they stated that teachers of partnership schools could not provide specific professional support to them during the practice period. Similarly, Maarof (2007) examines the reflective journal entries of 42 trainee teachers who underwent teaching practicum in schools in Malaysia. The study investigated the types of reflections, strategies, and perceptions of the trainees toward reflective journal/diary writing. The findings of the study indicated that 77% of the trainee stated that the task assisted them in evaluation their teaching methods, strengths, weaknesses, and problems in the teaching.

Boris (2016) cited Ahmed & Al-Khalili (2014) that examines the impact of reflective teaching approach on teaching skills of primary science student teachers. Data analysis revealed that the approach was effective on developing the overall teaching skills of elementary education student lesson, planning, introduction, use of new materials classroom management and evaluating their teaching and learning process, furthermore students involved indicated that the approach helps them in identifying strengths and weakness in teaching. They also indicated that it assists them in discovering means of correcting and improving their teaching.

Ogunbameru & Uwameiye (2012) studied the strategy for improving teaching practice in Nigerian Colleges of Education and suggested that reflective teaching should be adopted as a strategy for improving the teaching and learning competences of teachers in training to adequately prepare them for their professional roles and teachers. Also, Wubbles & Korthagen (1990) found that reflection assists in achieving quality learning. In a similar study, Zeichner (2007) noted that when educators reflect, they are able to make improvements in the quality of instruction. These and similar findings led Ostorga (2006) to conclude that because reflection informs teaching practices, strategies that aim to enhance reflective skills should be developed and implemented. Furthermore, national accrediting bodies, such as the NCATE, Certification bodies, such as the National Board for Professional Teaching Standards (NBPTS), and recognition organizations, such as the council for higher Education Accreditation (CHEA) all advocate for reflective thought on teaching as a valuable practice for the professional and future educators.

Research Hypotheses

The following null hypotheses were formulated and tested at 0.05 level of significance:

1. There is no significant difference in the academic achievement mean scores of students in the experimental and control groups before the treatment.
2. There is no significant difference in the academic achievement mean scores of male and female students in the experimental and control groups before the treatment.
3. There is no significant difference in the academic achievement mean scores of male and female students in the experimental and control groups after the treatment.

Methodology

The study was a pre-test, post-test quasi-experimental control group design. The target population of the study consisted of all Senior Secondary Class 1 (SS I) Physics teachers and students in all the public senior secondary schools in Ekiti West Local Government Area of Ekiti State, Nigeria. The population of Physics teachers presently in the public Senior Secondary schools in Ekiti West Local Government Area of Ekiti State is 32. The decision to use SS Class I students for the study is based on the assumptions that reflective teaching will fully integrate them into Physics class and that SS 1 students are considered knowledgeable enough to be able to read and understand the language of the questionnaire and be more responsive to a new strategy and able to have good interpretation while teaching them through reflective teaching.

The sample for this study comprised four senior secondary 1 (SS I) Physics teachers and all Physics students on ground in 4 schools (2 schools for experimental and 2 schools for control group) senior secondary Class 1 students. The sample was selected using multistage sampling technique.

The first stage was the selection of 4 schools out of 12 available public senior secondary schools in Ekiti West local government area, using simple random sampling technique. The second stage was the selection of 25 physics students (15 male and 10 female) from each of the four selected schools using stratified random sampling. (to give a total of 100 students). The participants were randomly assigned to the experimental and control groups respectively (two schools each per group).

The instruments used for the study was Physics Achievement Test (PAT). The Physics Achievement Test constituted the pre-test and post-test instrument for the students. The PAT was drawn by selecting questions relating to the topics that were covered by this study from the past questions of Senior School Certificate Examinations conducted by both West African Examinations Council (WAEC) and National Examinations Council (NECO). The research instrument designed for the study i.e. Physics Achievement Test (PAT) was validated by the experts. A field test was carried out which involved twenty five (25) senior secondary school (SS 1) students offering Physics randomly selected. The students were drawn from a school within the local government area which was not part of the schools selected for the study so as to avoid interactive effect of respondents. The mean score and standard deviation were obtained. Reliability was determined using Kuder Richardson-21 and found to be 0.87 at 0.05 level of significance which was considered reliable enough for use.

The package consisted of scheme of work and lesson notes on selected topics in Physics. The topics in the schools scheme of work prescribed for the period of this study by the Ministry of Education was used. The package was prepared on weekly basis according to the scheme of work for Senior Secondary School Physics. The outline for the lesson have date, period, topic, instructional objectives of the lesson (stated in behavioural terms) entry behaviour, instructional materials and the teachers' activities. Teacher's self-reflective rating package was given to the selected teachers to be completed by them first and then, the research assistants completed their own to provide a fuller understanding of the achievements of the participating teachers as well as areas they may need to continue working on. This was done weekly so that the teacher will readjust if need be. Audio recording was done at least once in each of the schools in the experimental group. Individual teacher had a diary of his/her written account of his/her lessons which were analysed and discussed by the teacher and the research assistants at least weekly. Steps to reflection were used by the mentor teacher and the teacher in the experimental group as part of the reflective package.

The research was in stages; the first stage is the training of the research assistant which lasted for one week, the second stage was the administration of pre-test to all the students participating in the study, this lasted for one week. The next stage was the treatment stage and this also lasted for four weeks while the last stage was the administration of post-test. Altogether, seven weeks were used for the study. The researcher personally visited the participant teachers. Each of the teachers was provided with the scheme of work and the lesson plans meant for the study. These lesson plans were studied and discussed with the teachers for proper lesson delivery.

The data collected were tested using t-test, Analysis of Variance (ANOVA) and Analysis of Co Variance (ANCOVA) at 0.05 level of significance.

Results and Discussion

Hypothesis 1

There is no significant difference in the achievement mean scores of students in the experimental and control groups before the treatment.

Table 1: t-test of students achievement mean scores in experimental and control groups before treatment.

Group	N	Mean	Standard Deviation	df	t-cal	t-table
Experimental	50	10.83	4.12	98	0.973	1.660
Control	50	10.10	3.31			

$P > 0.05$

Table 1 revealed that the experimental group has 50 students and same with the control group. The experimental group has a mean value score of 10.83 with standard deviation of 4.12 while the control group has a mean score of 10.10 with standard deviation of 3.31.

t-calculated (0.973) is less than t-table (1.660) at 0.05 level of significance. The null hypothesis is accepted. This implies that there is no significant difference in the achievement mean scores of students in the experimental and control group before the treatment.

Hypothesis 2

There is no significant difference in the achievement mean scores of male and female students in the experimental and control group before the treatment.

Table 2: 2 x 2 ANOVA of students' achievement by gender and treatment.

Source	SS	df	Ms	F _{cal}	F _{tab}	P
Corrected Model	72.193	3	37.406	0.894	2.86	.802
Gender	0.008	1	0.008	0.000	3.94	.862
Group	18.173	1	18.173	1.623	3.94	.120
Gender * Group	6.732	1	6.732	0.624	3.94	.120
Error	4644.216	97	8.654			
Corrected Total	9825.224	99				
Total	50912.000	100				

P > 0.05

Table 2 shows that F_{cal} (0.624) is less than F_{tab} (3.94) at 0.05 level of significance. The null hypothesis is accepted. This implies that there is no significant difference in the achievement mean scores of male and female students in the experimental and control groups before the treatment. Similarly the main effect of gender (F = 0.000, P > 0.05) and treatment (F = 1.623, P > 0.05) on students' achievement before the treatment is not statistically significant at 0.05 level in each case.

Hypothesis 3

There is no significant difference in the achievement mean scores of male and female students in the experimental and control groups after the treatment.

Table 3: 2 x 2 ANCOVA Summary of Students' achievement mean scores by gender and treatment.

Source	SS	df	MS	F _{cal}	F _{table}	P
Corrected Model	7831.612	4	1834.468	186.431	2.83	.000
Covariate (pretest)	76.226	1	76.226	8.264	3.94	.001
Gender	3.263	1	3.263	0.426	3.94	.460
Group	6162.134	1	6162.134	946.423	3.94	.000
Gender * Group	0.416	1	0.416	0.078	3.94	.000
Error	2781.624	96	6.582			
Corrected Total	8738.214	99				
Total	98123.126	100				

P > 0.05

Table 3 reveals that F_{cal} (0.078) is less than F_{table} (3.94) at 0.05 level of significance. The null hypothesis is accepted. This implies that there is no significant different in the achievement mean scores of male and female students in the experimental and control groups after treatment. Treatment had significant effect on students' achievement in Physics. (F = 1033.310, P < 0.05) while the effect of gender on students' achievement in Physics is not statistically significant at 0.05 level (F = 0.426, p > 0.05).

Discussion

The result of this study revealed that the pre-test mean scores of the students in the Reflective teaching strategy was not significantly different from that of those exposed to conventional method. The implication of this is that the two groups involved in the study exhibited comparable characteristics. Thus, they both entered the instructional experiment on equal strength and ability which showed that the two groups were suitable for the study when comparing Reflective teaching strategy with conventional method on achievement in Physics.

Considering the numerous steps involved in reflective teaching compared to the conventional method. The reflective teaching strategy is a seven step instructional action process comprising planning, observation, description, evaluation, analysis, conclusion and final action plan, in addition these process are followed by the briefing phase where the teacher makes decisions on what to do next if he/she come across such or similar situation he had encountered or observed. A process of self observation and self evaluation of his/her teaching. This will undoubtedly had given the students a good foundation in the subject hence the brilliant performance.

The finding also supported the findings of Derek (2007) who reviewed the seriousness of the deplorable performance of secondary school students in science subjects and identified persisted use of the traditional mode of instruction as one of the major shortcoming affecting the teaching and higher achievement in science subjects.

Based on these results, it could be inferred that reflective teaching strategy is far effective for the teaching of Physics in the secondary schools because a closer look at the result after treatment showed that it is more potent to the conventional method. The finding is supported by the submission of Ameh & Dantanai (2012) that the method adopted by the teacher may promote or hinder learning, sharpen mental activities which are the basis of social, power or discourage initiatives and curiosity thus making self-reliance and survival difficult.

The finding of this study corroborate that of Odunusi (1984) in Jegede (2003) who found out that sex of students is not a factor which significantly influences on attitude towards science, he therefore concluded that attitude is developed in the school since it can be argued that majority of students come to school with no particular interest in any subject.

On the other hand, this study negates the findings of some other studies, as some of the studies associate better performance with boys while the others associate it with girls. Hudson (2013) in an experimental study showed that male students achieve higher scores in Chemistry than the female students, whereas Anaso and Anaso (2006) in a similar study indicated that students in boys' schools perform better than those from girls school while Okwo and Otuba (2007) in a similar study noted that female students perform significantly better than their male counterparts. Thus far gender was exposed to the same treatment but treatment had significant effect on students' achievement in Chemistry. Research effort to link gender differences and achievement in science remain inconclusive but they have been able to reveal one interesting fact, that gender seems not to be as important in students' achievement as their innate ability. And instead of resolving this controversy, the findings of this present study in respect of gender related differences would appear to be strengthening the controversy.

Conclusion

Based on the findings of this study, it can be concluded that reflective teaching strategy is more potent in improving students' academic achievement in Physics in secondary schools than conventional method in vogue in the nation in term of academic achievement.

The study however found no significant difference between academic achievement of male and female students in Physics when reflective teaching was used as strategy of instruction. This simply implies that academic achievement of students taught using different teaching strategies is not in any manner affected by either their gender.

Recommendations

Based on the findings of this study, the following recommendations were made:

- i. Teachers should use reflective teaching strategy in teaching Physics as this will enhance students understanding of the content knowledge.
- ii. Workshop/seminars should be organised constantly for secondary school Physics teachers to adequately prepare them for their professional roles as teachers and that such skills as planning decision making, team work, collaboration problem solving and help seeking which are critical for survival in the twenty first century work setting.
- iii. Government should enact a policy that will encourage the use of reflective teaching in our schools
- iv. School management should give room for time and space for the practice of reflective teaching in our schools and also organised seminars at regular intervals in their schools. They should have objectives and goals favouring reflective teaching in our schools
- v. School authority should serve as facilitator who is considered an essential part of the learning setting in which teachers will understand the nature of reflection and its relation to the learning traits.
- vi. Curriculum experts in pre-service teacher's education should ensure utilization of reflective teaching programmes for the pre service teachers

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