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PEER-ASSESSMENT AND STUDENTS' ACADEMIC PERFORMANCE IN MATHEMATICS AMONG UNIVERSITY STUDENTS IN RIVERS STATE, NIGERIA

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Abstract

The study investigated peer-assessment and students' academic performance in mathematics among University Students in Rivers State, Nigeria. This study adopted correlation research design with a population of all the students offering mathematics in Ignatius Ajuru University of Education, Rivers State was used. A sample size of 1,960 mathematics students in Ignatius Ajuru University of Education, Rivers State. A stratified sampling technique was used to obtain the sample. The instrument for data collection was a researchers-structured questionnaire titled: Peer-Assessment scale (PAS) and Students' Academic Performance Scale (SAPS) with a reliability index of 0.80 and 0.90.The reliability of the instrument was obtained using the Pearson Product Moment Correlations Coefficient. Statistical tools were used to answer the research questions. The hypotheses were tested at 0.05 level of significance. Data analysis was done using descriptive statistics, Pearson product moment correlation and multiple regressions. The result revealed that peer assessment has a significant relationship with academic performance. The study recommended that peer assessment strategy should be used by teachers in the teaching and assessment of students in mathematics subject.

Key words: Peer assessment, Academic performance and mathematics.

Introduction

Mathematics is a core subject in the school curriculum which is necessary at both primary and secondary school levels in Nigeria. It is the foundation of scientific and technical knowledge that is important in the socio-economic development of the nation. However, it is used as central entry necessity into most of the professional courses at degree level such as economics, actuarial science, medicine, commerce, engineering, pharmacy and architecture as prescribed by JAMB and universities in Nigeria. Mathematics provides a powerful universal language and intellectual tool kit for abstraction, generalization and synthesis.(Smith in Dadughun, Sunday & Bulus, 2022).

Assessment according to Chikwe (2017) opines that it is one of the methods used in ascertaining or finding out how well students have performed during and after the teaching learning process. Assessment is not the only procedure utilized in generating scores and grading, but also a diagnostic tool that helps students understands areas of strength and weakness. Adeleke in (Chikwe, 2017) stated that primarily assessment is meant to diagnose areas where learners are having difficulty to allow for concentration of efforts in those areas; and teachers can evaluate their pedagogical strategies through assessment. However, assessment of students learning is a strategy the teacher cannot do away with as it helps in motivating students learn and strive for better performance.

Assessment is the recognized act or process of developing an opinion of value. It is an integral part of the learning process which should play a significant role in the educational model. It comprises of all activities to help learners recall what has been impacted to them, for example, tests, assignments, demonstration, illustration, and others on large scale or classroom level. It helps to connect students, clarify roles, promote learners, spread the scope of evaluation, and many more. Classroom assessment is often conducted by the teacher alone but education today requires assessment strategies that are student-centered, one of which is peer-assessment (Becker, 2017). Peer-assessment is the judgment of students' work by other students of equal status. Students often embark on peer-assessment in combination with self-assessment. They reflect on their own efforts, and extend as well as enrich this reflection by exchanging feedback on their own and their peers' works. Peer assessment or peer review provides a structured learning process for students to review and provide feedback to each other on their work. It helps students develop permanent skills in assessing and providing feedback to others. It also equips them with skills to self-assess and develop their life (Smitter, 2018).

Peer-assessment strategy is the procedure whereby students grade assignments or tests, of their mates or peers based on a teacher's benchmarks. Obilor and Adegbeye (2021). Race (2011) stated that peer-assessment approach encourages deep learning by the students; helps in developing clearer assessment criteria as a good way to generate timely response and it also leads to improvement in students' other assessment practices which enhances students' performance in their subjects. Juwah (2013) found in his study that peer-assessment and peer-learning were effective and efficient in ensuring the development of the desired knowledge, skill and capabilities required. He further emphasized that for peer-assessment to be efficient, rigorous and appropriate training must be provided to enable the participants disseminate themselves with the process of grading their peers' assignments to meet the teacher's benchmark so that more knowledge would be gained by the student on the subject's contents. Orsmond (2015) asserted that engaging students in peer-assessment can facilitate them in learning to evaluate their own learning and in interpreting assessment criteria. Further benefits might also comprise increasing feedback to students; reducing marking loads for staff; giving students a sense of ownership of assessment process; encouraging critical analysis of students' work, so students see beyond a mark/grade. He finally concluded that disadvantages are encountered when students lack the ability to evaluate each other, do not take the assessment seriously, or fear discrimination peer assessment is more than a method of classroom evaluation; it is also a critical teaching method that helps students build life-long skills. During peer evaluation, students learn how to be teachers, how to sift through information and identify valid data, and how to provide constructive feedback on performance. Peer assessment can improve the performance of other students through the feedback they give each other during interactions. Several studies (Double *et al*., 2020; Landry et al., 2014; Li & Gao, 2016; Li et al., 2020) observed a positive effect of peer assessment on student performance. However, in the study by Li and Gao (2016), the positive effects of peer assessment on

student performance were more pronounced among low-and average-performing students than among high-achieving students. ...where there was a positive effect of peer assessment on student performance. Similarly, the study by Rahmanian and Nouhi (2020) revealed a significant increase in the mean score of academic achievement in the group that participated in active and collaborative learning than in the control group. ...

Formative assessment is an essential part of teaching and learning. It does not add to the final marks given for the unit; instead, it put into learning through given advice. Also, it points out what is good about the work and what is not? Similarly, it also affects what the students and teacher will plan in the future for learning. Summative assessment shows the amount of learners' success in meeting the assessment. Also, it contributes to the final marks given for the unit. These are conducted at the end of units. In addition, it provides data for selection for the next level. The logic and dependability of summative assessment are of great importance. It can also provide information that has formative value (Andrade, 2017).

Dynamic assessment measures what students can achieve when teach about unfamiliar topic or field. An example can be teaching students Spanish for a short while. It helps to see how students who do not have any prior knowledge adopt it. It can be helpful to review the potential for students who have a mainly underprivileged backdrop. Frequently it is used in advance of the main body of teaching. Synoptic assessment gives confidence students to unite elements of their learning from different parts of a plan and to show their build up knowledge and thoughtful of a topic or subject area. It basically enables students to show their talents and skills. It shows how in-depth knowledge they have about the subject. Basically, it helps in measuring the capacity to apply knowledge to understand the subject (Adeyemi, 2012).

In formative peer-assessment, a collaborative learning technique, students evaluate their peers' work and have their own work evaluated by peers. Often used as a learning tool, peer-assessment gives students feedback on the quality of their work, with ideas and strategies for improvement. At the same time, evaluating peers' work can enhance the evaluators' own learning and self-confidence. It personalizes the learning experience, potentially motivating continued learning. When used in grading, it can give the instructor needed information on students' performance. Especially for large online classes, it may allow inclusion of assignments where students' creative work could not be graded reliably through automation or efficiently by teaching staff (Lladó, Soley, Roura-Pascual & Moreno, 2014).

Summative peer-assessment provides focus on learning and learners which are now a central theme in educational policies and practices. Peer-assessment is an important element of designing learning environments in order for them to become more participatory among students, which can achieve concepts such as learning between peers, collaborative learning, and problem-solving based learning (Kollar & Fisher, 2010). Summative peer-assessment shows the amount of learners' success in meeting the assessment. Also, it

contributes to the final marks given for the unit. These are conducted at the end of units. In addition, it provides data for selection for the next level. The logic and dependability of summative peer- assessment are of great importance. It can also provide information that has formative value. Summative peer-assessment yield benefits as one of the main modifications of the unilateral power that instructors keep during the assessment process.

Qualitative peer-assessment has been proven to have positive learning outcomes as a social process (Rimer, 2017).Qualitative peer-assessment gives effective, valid and reliable feedback to fellow learners, students need clear guidelines, training on assessment criteria and scoring rules, and practice with examples. Before students are ready to give feedback to others, their assessments should be compared to staff-grading of the same examples for quality assurance. Peer-assessment is used to enhance learning as an effective way to increase motivation for students by engaging them in the evaluation process (Rimer, 2017), and encouraging them to help each other to master the topic of learning.

Quantitative peer-assessment is an arrangement, a mode or method of assessing students for learners to consider/quantify and specify the level, value, or quality of a product or performance of other equal status learners, then learn further by giving elaborated feedback and discussing their judgments with peers to achieve negotiated agreed outcome. Quantitative peer-assessment aims to describe the assessment processes that foster future learning and mitigate difficulties that are expected to occur. It also aims to transform students from mere receivers of knowledge from teachers to memorize and recall on tests to active learners and participants in learning and evaluation processes, interaction, research and exploration of relationships between objects in order to generate new knowledge characterized by critical thinking and creativity. It helps to ensure quantitative education for all and develop learner's self-direction as one of the quantitative measures in education (Papinczak, Young, Li, Groves & Haynes, 2015).

Although quantitative peer-assessment seems to be time consuming at the initial stages, the intervention results in students becoming more reflective and self-critical leading to improved academic performance. Regular sharing and discussion of their work lead to increased confidence in their perception of themselves as learners. This system for learning is built on the basis of that learning directed around the learner with others for effective learning which focuses on the full integration of the student in the process of collaborative learning with peers under the supervision of the teacher (Thomas *et al*., 2011). In all, peer-assessment strategy intends to improve students' academic performance through assessment of the assignments of their peers using the teacher's benchmarks which can lead to an overall improvement in the students' achievement in a subject.

According to Avelino (2022) Ipsative assessment is the practice of retaking an assessment and comparing the results from the previous performance. This type of formative evaluation helps learners identify their mistakes and areas where they still need to improve, motivating them to perform better on their next assessment. The ipsative assessment builds

on the idea that learning is a process, and there is still room for improvement for those who have achieved a lower mark on their first attempt.

Avelino (2022) opines that Behavioral assessment, as its name suggests, is a psychological assessment that aims to assess a person's behavior. In a workplace setting, individuals are observed in a simulated work environment and shown realistic role-related scenarios. From there, they'll be asked to perform the best possible actions, like solving an issue or handling a conflict. How they respond to each situation will show you whether or not they are fit for the role.

Diagnostic assessment is the most favorite type of assessment of learning to check a learner's present knowledge base. Most of the time, it involves a series of questions given at the start of a class or training session to identify a learner's strengths and weaknesses prior to learning. Norm-referenced assessment, as well called NRT tests, is a type of assessment that significantly compares a learner's knowledge and presentation to another. This assessment ranks learners from highest to lowest to emphasize differences among them and point out who is ahead or behind the norm (Avelino, 2022).

Criterion-referenced assessment is a type of assessment that measures a learner's learning progress or performance based on pre-determined and agreed-upon criteria and standards. This evaluation doesn't contrast an individual against their peers. A criterion-referenced assessment directly measures up a person's skills and abilities to the condition, regardless of how the other test takers perform on the assessment (Avelino, 2022).

Avelino (2022) sees Scenario-Based Assessment as a type of assessment that involves a hypothetical scenario where learners are expected to apply their theoretical knowledge. Using this process, assessors will be able to see firsthand the level of expertise of their learners. Not only does it produce a more reliable evaluation of your employees' skills and knowledge, but this type of assessment also serves as an efficient way to help team practice and build up their skills. Scenario-based assessments provide a great opportunity to explore their role and function, without the pressure of being involved yet in a real-world situation. This study will, therefore look into the peer assessment and students' academic performance in mathematics among secondary school in Rivers State.

Statement of the Problem

It is common that student experienced dissatisfaction with a teacher's grading style, and this is because they are quite removed from the evaluation process. However, when you get them involved via peer assessment, they become more open to evaluation and can see the justification for their grades. Often times it is easier to deal with feedback and criticism when it comes from someone or people we are familiar with. There is certainly some degree of anxiety that comes with receiving feedback from higher authorities. Peer assessment is a good way for individuals to get familiar with constructive criticism.

Purpose of the Study

The specific objectives were to:

1. Investigate whether there is any relationship between formative peer-assessment and students' academic performance in Mathematics among University Students in Rivers State.
2. Examine whether there is any relationship between summative peer-assessment on students' academic performance in Mathematics among secondary schools in Rivers State.
3. To establish whether there is any relationship between quantitative peer-assessment on students' academic performance in Mathematics among secondary schools in Rivers State.

Research Questions

The following questions guided the study:

1. What is the extent of relationship between formative peer-assessment and academic performance of students in mathematics among university students in Rivers State?
2. What is the extent of relationship between summative peer-assessment and academic performance of students in Mathematics among university students in Rivers State?
3. What is the extent of relationship between quantitative peer-assessment and academic performance of students in mathematics among university students in Rivers State?

Hypotheses

The following null hypotheses were tested at 0.05 level of significance

1. There is no significant relationship between formative peer-assessment and academic performance of students in mathematics among university students in Rivers State
2. There is no significant relationship between summative peer-assessment and academic performance of students in Mathematics among university students in Rivers State
3. There is no significant relationship between quantitative peer-assessment and academic performance of students in mathematics among university students in Rivers State

Method

This study adopted correlation research design with a population of all the students offering mathematics in Ignatius Ajuru University of Education, Rivers State. A sample size of 1,960 mathematics students in Ignatius Ajuru University of Education, Rivers State was used. A stratified sampling technique was used to obtain the sample. The instrument for data collection was a researchers-structured questionnaire titled: Peer-Assessment scale (PAS) and Students' Academic Performance Scale (SAPS) with a reliability index of 0.80 and 0.90.The reliability of the instrument was obtained using the Pearson Product Moment Correlations Coefficient Statistic method to answer three research questions. The null hypotheses were used at 0.05 level of significance.

Results

Research Question one: What is the extent of relationship between formative peer-assessment and academic performance of students in mathematics among university students in Rivers State?

Table 1: Summary of Pearson "correlation on the extent of relationship between formative peer assessment and academic performance among university students in Rivers State.

Variables	Mean	SD	N	DF	R	Remark
Formative peer assessment	2.61	0.93	1958	2	0.117	weak
Academic Performance	2.61	0.78				

Table 1 above shows that positive and weak relationships exist between formative peer-assessment and academic performance among University students in Rivers State (r=0.117).This implies that the extent of relationship between formative peer assessment and academic performance is weak.

Research Question Two: What is the extent of relationship between summative peer assessment and academic performance among University Students in Rivers State?

Table 2: Summary of Pearsons Correlation on the relationship between summative peer assessment and academic performance among university student in Rivers State.

Variables	Mean	SD	N	DF	R	Remark
summative peer assessment	2.60	0.97	1958	2	0.293	weak
Academic Performance	3.15	0.78				

Table 2: above shows that a positive and weak relationship exist between summative peer assessment and academic performance among university Students in Rivers State (r=0.293).This implies that the extent of relationship between summative peer assessment and academic performance is weak.

Research Question Three: What is the extent of relationship between quantitative peer-assessment and academic performance of students in mathematics among university students in Rivers State?

Table 3: Summary of Pearson's correlation on the extent of relationship between quantitative peer assessment and academic performance among university students in Rivers State.

Variables	Mean	SD	N	DF	R	Remark

quantitative peer assessment	2.90	0.971	1958	2	0.334	Moderate
Academic Performance	3.15	0.78				

Table 3 above shows that a positive and moderate relationship exist between quantitative peer assessment and academic performance among university students in Rivers State (r=0.334).This implies that the extent of relationship between quantitative peer assessment and academic performance is moderate.

Ho_1: There is no significant relationship between formative peer-assessment and academic performance of students in mathematics among university students in Rivers State

Table 4: Correlation between formative peer-assessment and academic performance among university students in Rivers State.

	Formative peer	Academic performance	assessment
Formative peer assessment	Pearson Correlation	1	*117**
	Sig .(2-tailed)		.010
	N	1960	1960
Academic Performance	Pearson Correlation	*117**	1
	Sig .(2-tailed)	*010	
	N	1960	1960

**Correlation is significant at the 0.05 level (2-tailed).

Table 4 above shows the correlation between formative peer assessment and academic performance among university students in Rivers State. The table reveals that there is a positive correlation coefficient of 0.117** with the probability/significant value of 0.010 which is less than 0.05 level of significance. Therefore, the researcher concludes that there is a positive significant relationship between formative peer assessment and academic performance of university students in Rivers State. The null hypothesis one was therefore rejected since $p<0.05$.

Ho_2: There is no significant relationship between summative peer-assessment and academic performance of students in Mathematics among university students in Rivers State.

Table 5: Correlation between summative peer assessment and academic performance among university students in Rivers State.

	Academic performance	Summative Peer	assessment
Academic Performance	Pearson Correlation	1	*293**
	Sig .(2-tailed)		.000
	N	1960	1960

Summative Peer assessment	Sig .(2-tailed) N	*293** *010 1960	1 1960

**.Correlation is significant at the 0.05 level (2-tailed).

Table 5 above shows the correlation between summative peer assessment and academic performance among university students in Rivers State. The table reveals that there is a positive correlation coefficient of 0.293** with the probability/significant value of 0.000 which is less than 0.05 level of significance. Therefore, the researcher concludes that there is a positive significant relationship between summative peer assessments and academic performance among university students in Rivers State. The null hypotheses is two was therefore rejected since p<0.05.

Ho_3: There is no significant relationship between quantitative peer-assessment and academic performance of students in mathematics among university students in Rivers State.

Table 6: Correlation between quantitative peer assessment and academic performance among university students in Rivers State.

	Academic performance	Summative Peer	assessment
Academic Performance	Pearson Correlation	1	*334**
	Sig .(2-tailed) N		.000
Summative Peer assessment	Pearson Correlation Sig .(2-tailed) N	1960 *334** *000 1960	1960 1 1960

**.Correlation is significant at the 0.05 level (2-tailed).

Table 6 above shows the correlation between quantitative peer assessment and academic performance among university students in Rivers State. The table reveals that there is a positive correlation coefficient of 0.334** with the probability/significant value of 0.000 which is less than 0.05 level of significance. Therefore, the researcher concludes that there is a positive significant relationship between quantitative peer assessments and academic performance among university students in Rivers State. The null hypotheses is three was therefore rejected since p<0.05.

Discussion of Findings

The study revealed that the extent of relationship between formative peer-assessment and' academic performance among University Students was weak. In corresponding null hypotheses showed that there was a weak significant relationship between formative peer assessment and academic performance among university students in Rivers State. In line with this finding, Ndupuechi (2019) asserted that formative assessment is an essential part of teaching and learning. It does not add to the final marks given for the unit; instead, it

puts into learning through giving advice. Also, it points out what is good about the work and what is not? Similarly, Adeyemi (2012) reported that the use of peer- and self-assessment in Mathematics enhanced students' self-efficacy and promoted learner's autonomy. Especially for large online classes, Lladó, *et al*. (2014) opined that formative assessment allows inclusion of assignments where students' creative work could not be graded reliably through automation or efficiently by teaching staff. The intent of formative peer-assessment is to help students help each other plan their learning, identify their strengths and weaknesses, target areas for remedial action, and develop meta-cognitive and other personal and professional skills.

Further, the study showed that the extent of relationship between summative peer-assessment and academic performance among university students in Rivers State was weak. This finding is supported by Andrade (2017) who stated that summative assessment shows the amount of learners 'success in meeting the assessment, and it contributes to the final marks given for the unit. Summative peer-assessment provides focus on learning and learners which are currently the central theme in educational policies and practices and it helps achieve concepts of learning between peers, collaborative learning, and problem-solving based learning (Kollar & Fisher, 2010). Also, in line with this finding, Tan (2017) asserted that summative peer-assessment yields some benefits as one of the main modifications of the unilateral power that instructors keep during the assessment process. Maddalena (2011) emphasized that such modification of power relationship cannot be achieved unless students are allowed to implement summative peer-assessment. Finally, the findings in research three revealed that the extent of relationship between quantitative peer assessment and academic performance among university students was weak. Supporting this result, Rimer (2017) established in his study that qualitative peer-assessment is an evaluation of different types of feedback on the quality of students' work for corrective, reinforcing, didactic and suggestive reasons. According to him, qualitative peer-assessment of students' assignments is based on three dimensions: creativity, relevance and feasibility. It provides advantages for students' perceptions.

Conclusion

This study has shown that there is a relationship between peer assessment and academic performance in mathematics among university students. Teachers need to be continuously exposed to training programmes in order to update their skills and knowledge in the light of a changing educational system, as to advance their teaching effectiveness.

Recommendations

1. The government should provide fund to the universities which will be used to organize regular in –service training, workshop and conferences for teachers to develop their capacities.
2. The school administrator should give equal and regular opportunities for teachers to attend development programmes.

3. Teachers at various levels in the teaching profession should always lay emphasize on programmes and trainings that will enhance their professional development.

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