



Effect of Self-Assessment And Peer-Assessment Techniques On The Performance Of Undergraduate Students In A Basic Statistics Course

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ABSTRACT

This study investigated the impact of self-assessment and peer-assessment techniques on the performance of undergraduate students in a basic statistics course at Ignatius Ajuru University of Education, Rivers State, Nigeria. The study adopted the quasi-experimental research design using a sample of 184 undergraduate students who were divided into two groups. Two research questions and their corresponding null hypotheses were developed to guide the study. Data was collected at pre-test and post-test phases over an eight-week period. Data collected were analyzed using mean and standard deviation to answer the research questions, while dependent samples t-test was used to test the null hypotheses. Results showed that both assessment techniques had a significant positive effect on students' performance. However, the result further showed that those in peer-assessment groups performed significantly better than those in the self-assessment group, even after controlling for the pretest. Based on the result obtained, it was recommended that these alternative assessment techniques should be integrated into university assessment practices.

Keywords: Self-assessment; peer-assessment, assessment techniques; academic achievement.

INTRODUCTION

In addition to curriculum and instruction, assessment has been defined as one of the foundational pillars of any effective educational process in the contemporary world. This observation has been well articulated by various authorities, as such it is vital that the concept of assessment is well elaborated and documented to understand the most efficacious approach of helping students benefit from the educational process. From this perspective, Elliot, Kratochwill, Cook and Travers (2000) averred that effective teaching involves providing students with adequate instruction based on the prescribed curriculum but more importantly giving them appropriate feedback about their work effort and performance. Similarly, in the opinion of Orluwene and Ekim (2015), assessment is the hallmark of effective teaching as it provides educators, teachers, parents and the society in general with empirical and valid evidence on the effectiveness of the curriculum as well as the extent to which the instructional objectives developed to guide instructions have been achieved.

As important as assessment in the educational context, the concept is yet to attain a universally acceptable definition among practitioners and researchers. Therefore, the concept has been used variously both in terminology and operationalization. Furthermore, due to a large number of stakeholders interested in the concept of assessment, there has been various dimensions and types of assessment in the literature. However, the definition of assessment posited by Salvia and Ysseldyke (2004:4) in which it was conceptualized as the process of collecting educational data for the purpose of making decisions about individuals and group appears to offer a generic conceptualization of assessment that is accepted within the educational sector. Embedded in this definition of assessment are three elements that should characterize every form of assessment. These are process, reason and assumptions. As a *process*, assessment involves observation or collection of data over time; as regards *reason*, it is always conducted

to provide answers to a specific educational question such as 'How well can Student A identify alphabets?' or 'Is Student B ready to move to another educational level?' With respect to *this assumption*, it seeks to identify possible factors promoting or inhibiting learners' performance.

The centrality of assessment in education was further confirmed by Orluwene (2012) wherein it was argued that "assessing students' knowledge and skills is a central issue in schools. Effective teaching and learning cannot be said to have taken place without appropriate assessment because it provides evidence for the success or failure of instruction and direction of students' attainment. This definition is similar to that offered by Ukwuije (2013) in which assessment was defined as the process of documenting, usually in measurable terms, the knowledge, skills, attitudes, beliefs, practices or generally what behaviour a learner does or does not have, acquire or develop, before, during or at the end of instruction, or a course of study. In this study, assessment is defined operationally as the process by which information about students' knowledge, skills, ability, belief, aptitude, attitude, performance, competencies and opinions are gathered, analysed, interpreted and utilized to assist students to benefit optimally from a programme of instruction as well as make decisions to either continue, adapt or terminate the programme.

As shown from the above assertion, the central goal of assessment is the attainment is the improvement of students' learning. As such there have been various types and strategies that have been recommended for students' assessment. For example, Qu and Zhang (2013) classified assessment into two broad types based on purpose, namely formative and summative assessments. Formative assessment is provided during the course of learning, while summative is provided at the end of learning for certification purposes. While this distinction has theoretical benefits, practical experience shows that these two functions need to overlap for assessment to be functional. It was in this direction that Hernandez (2012) argued that assessment strategies in higher education should involve both formative and summative strategies.

In the higher education context, traditional assessment has been criticized for failing to reflect the reality of students' everyday experience. As such, there has been a renewed call for a move from traditional assessment to what has been termed "authentic assessment". Authentic assessments focus not on how much students' remember but on how they can reflect what has been learnt in a new environment. It involves the use of multiple assessment activities which seeks to involve students in the assessment process to demonstrate problem-solving skills, application of knowledge, and communication of new information (Gibson & Shaw, 2017). Two modes of assessment have been identified as contributing to a more authentic assessment. These are peer- and self-assessment.

Peer- and self-assessment techniques align with the social constructivism approach which argues for the involvement of students in the instruction and assessment process. Orluwene and Ekim (2020) posit that self-assessment involves allowing students to assess their performance based on specific criteria. It further allows them the opportunity to reflect and make judgment on their submitted academic task. The goal of self-assessment as captured by Efklides (2011) is to enable students to judge their progress and use the insight gained to improve future performances. On the other hand, peer-assessment is used when students are required to grade other students' work based on specified and generally agreed-upon criteria. Defining it specifically, Orluwene and Ekim (2020) stated that it is the process by which students are given the responsibility of identifying the quality of their classmates' work based on an identified benchmark to ascertain the extent to which learning objectives have been achieved.

Various authorities have informed on the importance and relevance of these assessment techniques to students of higher education including undergraduates. According to Cornell University (n.d.), these techniques empower students to take responsibility for and manage their own learning, enable students to learn to assess and give others constructive feedback which develops life-long skills, enhance students' learning through knowledge diffusion and exchange of ideas, as well as motivate students to engage with course materials more deeply. Contributing further, Sambell, McDowell, and Montgomery (2013), states that both assessment modes help students develop essential skills such as independence, personal responsibility, and critical thinking. It also helps students with a better understanding of how to handle criticism and how to judge others' work responsibly (Chetcuti & Cutajar, 2014).

Despite the proposed importance and significance of these assessment formats, little or no effort has been expended towards ascertaining their effect in the Nigerian context. A notable exception is a study by Orluwene and Ekim (2020). In their study which investigated the effect of self- and peer assessment techniques on self-regulated learning among secondary school students in Rivers State, it was shown that both techniques when used jointly had a significant positive effect on students' self-regulated learning. A secondary result obtained from the study was that self-assessment has a greater effect on the self-regulated learning strategy of secondary school students than peer-assessment.

In a similar direction, Sharma, Jain, Gupta, Garg, Batta, and Dhir (2016) investigated the impact of self-assessment on medical students learning in India. Using a sample of 89 students admitted into a medical programme. The result showed that self-assessment had a positive effect on the learning of students. Furthermore, a secondary result of the study showed that students had a positive attitude towards the use of self-assessment in their learning programme. In a similar study, Price (2016) investigated the effect of self-assessment strategy on the academic performance of students in Mathematics. The result of the study showed that students who were taught using self-assessment strategies had a significantly higher level of academic performance than those who received a tutored-assessment strategy. Finally, McDonald and Boud (2003) investigated the impact of self-assessment on the achievement of students on external examination. Data for the study was obtained from a sample of 256 high school students who were trained in self-assessment strategies, while a control group was gotten which did not receive any formal training on self-assessment but were assessed by their teachers. The result from the study showed that a significant difference favouring those trained in self-assessment was obtained. From this brief review of empirical literature done, it is shown that there is almost a consensus on that self-assessment has a significant effect on improving students' learning and performance.

On the effect of peer-assessment, the result has returned on a lack of consensus unlike in self-assessment. Commenting on the challenges of peer assessment, Snowball and Mostert (2013) stated that there is some debate as to the appropriate academic level at which to implement it, especially with essay-based assessments. In their study, the researchers found that there was a significant difference in the assessment between peers' preliminary assessment and those of their tutors at the end of an economics course. This was because in general, peers gave more important feedback on technical aspects, such as presentation and referencing than on content. In their meta-analysis of the impact of peer assessment on academic performance among primary, secondary and tertiary students across different subjects and domains, Double, McGrane and Hofenbeck (2020) reported that peer assessment had an overall medium effect on the academic performance of students. The result suggests that peer assessment improves academic performance compared to no assessment and teacher-based assessment. Furthermore, the result indicates peer assessment was remarkably robust across a wide range of contexts. These findings provide support for peer assessment as a formative practise and further called for the implementation of peer assessment in the classroom.

Using a two-way factorial quasi-experimental design, Li and Gao (2015) investigated the effect of peer assessment on project performance of students at different learning levels. The study was conducted using a sample of 130 teacher-education students divided into two groups, with the experimental groups working on a technology-integrated lesson plan project completing an online-peer assessment process, while the control group worked on a similar technology-integrated lesson plan, but followed the traditional discussion method without any peer-assessment feedback. Students' learning levels were measured and divided into low-, average-and high-achieving according to the quality of their draft lesson plans. Result revealed that while low-and average-achieving students showed significantly improved performance right after the integration of a peer assessment model, the model seemed to have had less impact on the performance of high-achieving students.

On the impact of peer assessment on academic performance, the final study reviewed here is that of Jhangiani (2016) who investigated the impact of participating in a peer assessment activity among Canadian students. Sample for the study comprised of students taking an introductory psychology course. While students in Students in the experimental group participated in a five-step double-blind peer assessment activity immediately following the practice quiz, whereas those in the control group

participated in the identical activity 1 week after the exam. Results show that participation in the peer assessment activity enhanced subsequent exam performance in all three cases, even after accounting for online mastery quiz performance and attendance.

From the review done above, it is shown that much of the result has yielded a positive effect of self-and peer-assessment on the academic performance of students in other climes. With the exception of Orluwene and Ekim (2020) study, the other studies reviewed were conducted outside Nigeria. Furthermore, their study was conducted using secondary school students. Considering that university students were more matured, this study investigated the impact of self- and peer-assessment techniques on the performance of pre-service teachers in a basic statistics course.

Research Questions

In order to guide this study, the following research questions were answered:

1. What is the effect of self-assessment on the academic performance of undergraduate students in basic statistics?
2. What is the effect of peer-assessment on the academic performance of undergraduate students in a basic statistics course?
3. To what extent do self-assessment and peer-assessment influence the academic performance of undergraduate students in a basic statistics course?

Hypotheses

The following null hypotheses were tested at 0.05 level of significance to guide the study:

1. Self-assessment does not have any significant effect on the academic performance of undergraduate students in basic statistics.
2. Peer-assessment does not have any significant effect on the academic performance of undergraduate students in basic statistics.
3. There is no significant difference in the extent to which self-assessment and peer-assessment affect the academic performance of undergraduate students in basic statistics.

METHODOLOGY

The non-equivalent pre-test-post-test only group quasi-experimental design was used for the study to ascertain the extent to which self-assessment and peer-assessment affect the academic performance of undergraduate students in basic statistics. A non-equivalent sample of 184 undergraduate students from the Ignatius Ajuru University of Education was used as the sample for the study. The sample was drawn from two departments in the Faculty of Education. The two departments were drawn using simple random sampling techniques. Furthermore, students in the two departments were randomly assigned to self-assessment and peer-assessment groups.

For the purpose of data collection, a modified achievement test developed from previous examination questions was used. The instrument was made up of 60 items. The instrument was first administered to students in both groups in order to get the values for the pre-test. Thereafter, the instrument was subsequently administered on both groups after the administration of treatment.

Experimental Procedure

The experimental procedures were executed into three broad phases namely pre-test, intervention and post-test. During the phase, the researcher informed the students of both groups on the approach that would be taken for the course. Thereafter, the researcher administered the instruments on students of both groups to get the pre-test scores while also informing them of their roles and activities. The experiment took place for a period of six weeks after the pre-test phase. In the six weeks, students were taught six topics for three hours in each week. Students in both groups were given classwork at the end of each class to work on. After the class, students in the self-assessment group were provided with the scoring rubrics and asked to grade themselves. On the other hand, students in the peer-assessment group were given the rubrics and required to grade their peers while also making feedbacks on the content. Students in both groups were allowed to reflect on the feedback obtained, either from self or from peers. Students' scores during the process of the treatment were not collected, but only served the purpose of feedback and reflection. At the end of the 7th week, the test was administered again to collect data for the post-test.

Scores obtained from both administrations were subjected to mean and standard deviations to answer the research questions, while dependent samples t-test and Analysis of Covariance were used to test the corresponding null hypotheses at 0.05 level of significance. The results obtained are presented below.

RESULT PRESENTATION

The answer to all the research questions, as well as for hypothesis one and two were presented in Table 1 below after the data obtained at the pre-test and post-test phases were subjected to mean and standard deviation analysis.

Table 1: Mean and standard deviation students’ performance in self-assessment and peer-assessment groups

Group	Test Mode	N	Mean	St.D	Mean Difference	df	t-value	p-value
Self-Assessment	Pre-test	93	24.63	5.83	6.54	92	106.89	0.0005
	Post-test		31.17	6.42				
Peer Assessment	Pre-test	91	23.91	4.75	13.35	90	205.41	0.0005
	Post-test		37.26	5.37				

From the result presented in Table 1, it is revealed that when the mean scores of students in the self-assessment group were compared at pre-test (24.63) and post-test (31.17) phases, a mean gain difference of 6.54 was obtained. For students in the peer assessment group, their mean at pre-test was 23.91 while at post-test their mean value was 37.26 which yielded a mean difference of 13.35. Based on obtained mean values, it, therefore, indicates that students in the peer assessment group had a higher level of academic achievement gain than those in the self-assessment group.

Furthermore, from the testing of the hypotheses one, it was shown that when these mean differences were tested at 0.05 level of significance, a t-value of 106.89 was obtained with a corresponding p-value of 0.0005 which was lesser than 0.05. This result indicates that there is a significant difference in the pre-test and post-test mean score of students in the self-assessment group. The null hypothesis was therefore rejected. Similarly, for hypothesis two, the result showed that a t-value of 205.41 was obtained which had a corresponding p-value of 0.0005 which was lesser than the chosen alpha of 0.05. Based on this result, it, therefore, indicates that peer-assessment had a significant impact on the academic achievement of undergraduate students in the statistics course.

Table 2: Analysis of Covariance of the effect of self- and peer-assessment on the academic achievement of students in statistics

Dependent Variable: POST-TEST

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	8045.669 ^a	2	4022.834	15357.605	.000
Intercept	418.719	1	418.719	1598.507	.000
Pretest	6422.499	1	6422.499	24518.583	.000
Group	2127.801	1	2127.801	8123.109	.000
Error	47.412	181	.262		
Total	223079.129	184			
Corrected Total	8093.081	183			

a. R Squared = .994 (Adjusted R Squared = .994)

According to the result displayed in Table 2 which reported the effect of self-assessment and peer assessment on the academic achievement of students in a basic statistics course, an F-value of 8123.109 was obtained at 1 and 181 degrees of freedom with a corresponding p-value of 0.0005. Based on the result obtained, it, therefore, indicates that peer-assessment had a significantly higher impact on the academic achievement students in statistics than self-assessment.

DISCUSSION

The result obtained on the impact of self-assessment showed that students who were exposed to self-assessment had an improved level of academic achievement when compared to their achievement before the period. This result might have been attributed to the fact that students had the opportunity of reflecting on the contents of their assignment as well as gain better insight on ways to solve the problem in the test. This result is similar to that obtained by McDonalds and Boud (2003) who found out that students in self-assessment groups had better performance than those in traditional assessment groups.

From research question two and the corresponding null hypothesis, the result showed that students who were assessed using peer-assessment had a significantly higher academic performance when compared to their pre-treatment phases. This result might be attributed to the fact that students who are exposed to peer-assessment were able to learn from the feedback provided by their peers who might have gotten a better approach to resolving the challenge. In addition, through discussions and exchange of ideas, the students might have learnt new skills to address the problem. This result is similar to that obtained by Double, McGrane and Hofenbeck who showed that peer-assessment had a significant medium effect on the academic performance of students than traditional assessment conducted by teachers with or without feedback.

Finally, from the last research questions and the corresponding null hypothesis, it was shown that students in the peer-assessment group had a significantly higher level of academic achievement than those in the self-assessment group. This result is contrary to that obtained by Orluwene and Ekim (2020) who found that students in self-assessment groups had a significantly higher level of self-regulated learning than those in the peer-assessment group. The difference in this result might be attributed to the fact that students in their study were assessed for self-regulated learning, while students in this study are assessed for academic achievement in a statistics course.

RECOMMENDATIONS

Based on the result obtained from this study, the following recommendations were made:

1. Education policymakers should engage more in promoting the use of self- and peer-assessment in the school system as this has been shown to improve on students' academic achievement.
2. Teacher education programs should include programmes and modules to enable teachers to effectively execute self- and peer-assessment effectively in the classroom.
3. Students should be given the opportunity to implement alternative assessment strategies during continuous assessment exercise. This would provide additional opportunity for them to get prompt feedback on their performance as against the use of summative assessment at the end of examinations.

REFERENCES

- Chetcuti, D. & Cutajar, C. (2014). Implementing Peer Assessment in a Post-Secondary (16–18) Physics Classroom. *International Journal of Science Education*, 36(18), 3101-3124
- Cornell University (n.d.). *Assessment and evaluation*. Retrieved from <https://teaching.cornell.edu/teaching-resources/assessment-evaluation>
- Double, K.S., McGrane, J.A. & Hopfenbeck, T.N. The Impact of Peer Assessment on Academic Performance: A Meta-analysis of Control Group Studies. *Education Psychology Review*, 32, 481–509. <https://doi.org/10.1007/s10648-019-09510-3>
- Efklides, A. (2011). Interactions of metacognition with motivation and affect in self-regulated learning: the MASRL model. *Educational Psychologist*, 46(1), 6-25.
- Elliot, S.N., Kratochwill, T.R., Cook, J.L. Travers, J.F. (2000). *Educational psychology: Effective teaching, effective learning*. Boston: McGraw Hill.
- Gibson, K., & Shaw, C. (2017, December 22). Assessment of active learning. *Oxford Research Encyclopedia of International Studies*. Retrieved from <https://oxfordre.com/internationalstudies/view/10.1093/acrefore/9780190846626.001.0001/acrefore-9780190846626-e-120>.

- Hernández, R. (2012). Does continuous assessment in higher education support student learning? *Higher Education*, 64(4), 489-502. <https://doi.org/10.1007/s10734-012-9506-7>
- Jhangiani, R. S. (2016). The impact of participating in a peer assessment activity on subsequent *academic performance*. *Teaching of Psychology*, 43(3), 180–186. <https://doi.org/10.1177/0098628316649312>
- Li, L & Gao, F. (2015). Effect of peer assessment on project performance of students at different learning levels. *Visual Communication and Technology Education Faculty Publications*, 33. https://scholarworks.bgsu.edu/vcte_pub/33
- McDonald, B & Boud, D. (2003). The Impact of Self-assessment on Achievement: The effects of self-assessment training on performance in external examinations. *Assessment in Education: Principles, Policy & Practice*, 10(2), 209-220, DOI: 10.1080/0969594032000121289
- Orluwene, G. W. & Ekim, D. K. (2020). Promoting self-regulated learning through self- and peer-assessment techniques among secondary school students. *International Journal of Arts and Commerce*, 9(4), 1-16.
- Orluwene, G. W. (2012). *Fundamentals of testing and testing non-testing tools in educational psychology*. Port Harcourt: Harey Publishers.
- Price, K. (2016). *The effects of self-assessment on academic performance*. Unpublished Masters' Thesis, Goucher College. Retrieved from <https://mdsoar.org/bitstream/handle/11603/3084/Price,%20Kathryn%20The%20Effects%20of%20Self-Assessment%20on%20Academic%20Achievment.pdf?sequence=1>
- Qu, W. & Zhang, C. (2013). The analysis of summative assessment and formative assessment and their roles in college English assessment system. *Journal of Language Teaching and Research*, 4(2), 335-339.
- Salvia, J. & Ysseldyke J.E. (2004). *Assessment in special and inclusive education*. U.S.A.: Houghton Mifflin.
- Sharma, R., Jain, A., Gupta, N., Garg, S., Batta, M., & Dhir, S. K. (2016). Impact of self-assessment by students on their learning. *International Journal of Applied & Basic Medical Research*, 6(3), 226–229. <https://doi.org/10.4103/2229-516X.186961>
- Snowball, J. D. & Mostert, M. (2013). Dancing with the devil: formative peer assessment and academic performance. *Higher Education Research & Development*, 32, 4, 646-659, DOI: 10.1080/07294360.2012.705262
- Ukwuijie, R. P. I. (2013). *Educational assessment: A sine qua non for quality education*. 108th Inaugural Lecture Series. Port Harcourt: University of Port Harcourt Press