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Journal of Education in Developing Areas

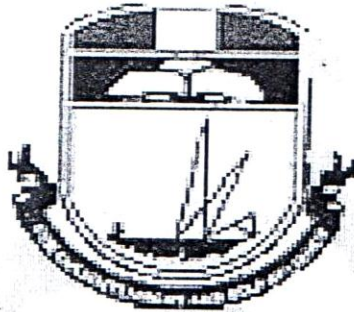
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**JOURNAL OF EDUCATION IN DEVELOPING AREAS
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The Journal of Education in Developing Areas (JEDA) is a journal of the Faculty of Education published twice in a year (March and October). The main focus of the journal is on education, with implications for developing areas. Its main objectives are:

- i. To provide a medium for the systematic analysis of contemporary educational theories and issues
- ii. To serve as a forum for the dissemination of research findings in the fields of education in developing areas
- iii. To provide a platform for the discussion of innovative ideas for the improvement of education in developing areas

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EFFECTS OF PEER-ASSESSMENT SKILLS TRAINING ON UPPER BASIC STUDENTS' MATHEMATICS ACHIEVEMENT IN ILORIN, NIGERIA

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Abstract

This study investigated the effects of peer-assessment skills training on upper basic students' mathematics achievement in Ilorin, Nigeria. The study employed a mixed method design with two research questions and three hypotheses generated to guide the study. The target population for the study consisted of all public upper basic schools (JHS) in Ilorin, Nigeria. Simple random sampling technique was applied to select a sample size of 74 upper basic school students. Mathematics Performance Tests and Peer Assessment questionnaire were the instruments used for data collection. Analysis of Covariance and thematic analysis of the qualitative data were used to test the hypotheses and the research questions respectively. The result of the study showed that there is significant difference in peer assessment test among participants exposed to the training condition and that of the control groups. However, the study also revealed that there is no significant gender difference in peer assessment among experimental conditions. It is therefore recommended that in teaching mathematics, Peer-assessment should be introduced in teaching students in schools and should be part of the curriculum of teaching Mathematics.

Keywords: Gender, instructional rubrics, mathematics and peer assessment.

Introduction

The act of assessment is inevitable in human activities because it is a tool used to evaluate performance, maintain standard using sets of criteria as a bench mark to judge the work of people in and out of classroom. Hence, its role in promoting effective teaching and learning process cannot be over-emphasized. Kellaghan and Greaney (2001) stated that assessment in educational setting refers to any procedure or activity that is designed to collect information about the knowledge, attitudes, or skills of learner or group of learners. It could be submitted from this definition

that assessment is one of the basics demand in school accountability. There are many modes of assessment such as short writing exercises, reviews, portfolios, observation, group project works, direct, interview, formative, summative and peer assessment among others. This paper is basically centered on peer assessment. Peer assessment is process by which students assess assignments or test of their peers based on teacher's benchmark or instructional rubrics (Sadler & Good, 2006). In the view of Asuai and Adeleye (2013) it is a peer moderated marking of students' work based on sets of criteria from the teacher. They opined again that it is the process undertaken by students to assess the performance or contribution of themselves and their peer group, in addition to a group task. The importance of peer interaction is also emphasized under the constructivist culture, to assist learners construct knowledge in a social setting since learning occurs in social contexts (Kaymakamoglu 2014). In constructivist education, learners construct knowledge and make meaning through social dialogue and interaction with the environment (Dolittle & Camp 1999).

Traditionally, students were seen as passive receivers of information in the classroom who were expected to provide samples of their knowledge in teacher-made tests. The teachers' roles are to give out instructions and also as the judge who evaluated students' success. This process would make the students passive and not active because they only listen to instructions given to them. More recently however, alternative ways of assessment are being tried and one of such is peer assessment. Peer assessment is used to describe the process undertaken by students to assess the performance/contribution of themselves and their peer group, in relation to a group task (Loddington, 2008). It could also be described as peer moderated marking of students' work based on sets of success criteria from the teacher. In peer-assessment, there is need to involve both the teachers and students so that the students will be aware of the success criteria and the process of grading. One of the ways in which students internalize the characteristics of quality work is by evaluating the work of their peers. However, if they are to offer meaningful feedback, students must have a clear understanding of what they are to look for in their peers' work. What teachers expect must be explained clearly to the students before they start assessing one another. For effective understanding of the peer assessment, the teacher will provide a sample of work done or an assignment with instructional rubrics for practice to enable them grades each other. This will give the students' confidence in marking their scripts without being bias. For peer assessment to be effective, the learning environment in the classroom must be supportive. Students must feel comfortable and trust one another in order to provide honest and constructive feedback because they were selected from different group (the weak students mixed with the strong students). This allows them to become more comfortable with each other and this may lead to better peer feedback.

Peer assessment is conceptualized as an educational arrangement where students judge peers' performance by providing grades and /or offering written or oral feedback (Topping, 1998). According to Falchikov, (2005) and Sivan, (2000) peer assessment is a process through which students and instructors share in the evaluation of student work. Researchers have found that peer assessment deepens students' understanding of their own learning and empowers students to become more actively engaged and self-directed in their learning processes. Falchikov, (2005) submitted peer assessment can be implemented by identifying learning activities for which peer feedback would be helpful to students. This is done when the degree to which students are to be involved are considered. The level of involvement could be low or high. In low level of students' involvement an instructor prepares model answers and guidelines for feedback, which students will use to assess the work of peers, peer assessment grades are only recommended while the instructor makes final grading decisions. Also, Students are required to participate and any student unhappy with a peer assessment grade could seek an independent assessment from the instructor. In the highest level of student involvement, both students and instructors work together to prepare model answers and scoring guidelines. Students then use the negotiated guidelines to assess the work and are responsible for providing feedback to the peers.

Sivan (2000) itemized most effective steps to implement peer assessment as:

- i. make the guidelines easy to implement;
- ii. fully train students on the implementation and importance of the guidelines;
- iii. require assessors to justify their judgments;
- iv. create a classroom environment that feels safe for interpersonal risk-taking so that students will feel more confident in evaluating their peers;
- v. share the responsibility of the final grade between the instructor and students if concern exists about student bias;

- vi. emphasize to students that the main focus of their peer assessment should be useful feedback, not grading;
- vii. use clear guidelines;
- viii. monitor use of guidelines by the students;
- ix. help students learn to provide effective feedback by modeling appropriate, constructive criticism and descriptive feedback;
- x. use small feedback groups so that feedback can be explained and discussed with the receiver;
- xi. encourage students to be as supportive as possible in critiquing the work of other students;
- xii. stress benefits of being a peer assessor to students, such as it helps them evaluate their own work and become more self-directed learners; and
- xiii. train students how to interpret feedback so that they can make appropriate connections between the feedback received and the quality of their work.

The primary goal of assessment is to identify discrepancies between the expected and actual performance, thereby giving students the opportunity to take corrective action. (Gienlen, Peters, Dichy, Onghena & Snyders, 2010). According to Sadler and Good (2006) the use of instructional rubrics as peer assessment tool for learning has contributed to excellent performance among secondary school students. It has also been found that peer assessment tends to differ among students when unsupported by assessment rubrics table, checklist, exemplification, teacher assistance and monitoring (Stefani, 1994; Pond, Ul-Hag & Wade, 1995). McMillan and Hearn (2008) opined that providing evaluation criteria through rubrics, models or anonymous exemplars helps students to concretely understand outcomes and expectations. It also helps students to understand and internalize the steps necessary to meet the goals. However, they cautioned that not all rubrics are equal to promote learning and that rubrics must indicate levels of proficiency and not just scores for grades. To Schamber and Mahoney (2000), when the combination of writing assignment and the use of a rubric were applied on some students, it improved the scores in an assessment of critical thinking skills by 41%. However, there exist also some studies presenting results which were not straightforward. Goodrich and Boulay (2003) concluded a study on writing performance when students were supported by rubrics and self-assessment and they reported positive effects only for some of the group investigated and the results sometimes differed between gender. Nelson and Schunn (2009) further showed that students were less likely to use peer assessment if they did not trust their peers' competencies.

Researchers also proposed that students who were involved in peer assessment often do not perform well in providing constructive and elaborated feedback unless they have high level of subject matter knowledge and experience in peer assessment (Van Zundert, Slijmans, Konings & Van Merriënboer, 2012). A challenge perceived by Kaaufman and Schunn, (2011), Liu and Careless (2006), Papinzak, Young, Groves and Haynes, (2007) was that students are unwilling to criticize the work of their peers. They often are reluctant to assess fellow students well and perceive themselves to be unqualified for peer assessment. The usefulness and importance of feedback (peer assessment) cannot be underestimated, according to Cevik, Haslama and Cevik, (2014) students' perceptions of the usefulness and importance of peer feedback influence the extent to which they utilize feedback for revision. Van der Pol, Van der Berg, Admiraal and Simons (2008) revealed that the more students perceived the feedback as important, the more they agreed with it and in turn showed a higher level of use of the feedback.

Hattie and Timperley (2007) opined that students who wish to confirm positive self-belief rather than focus on learning goals are more likely to adopt or seek feedback that maximizes positive self-evaluations and minimizes negative self-evaluation. Accordingly, feedback can be largely ignored when individuals' have too much confidence in the correctness of their response. Research has demonstrated that students' perceptions of feedback usefulness and importance are closely related to the type and source of feedback. On the type, Dominguez, Gonzalez, Mai, & Pefresa, (2012) indicated that students' perceived feedback with elaborated and specific comments to be more useful than simple and generic feedback. According to Kaufman and Schunn (2011) students' perceptions of the usefulness and importance of peer feedback also depended on the degree to which they think that feedback they received is unbiased.

Statement of the Problem

Mathematics is an indispensable subject because it is a subject that every student must register and pass (Federal Republic of Nigeria, 2004). Good performance in mathematics by learners is an access to probably advance to other levels in future, thus it is accorded a premium position among school subjects. Objectives of Mathematics at the upper basic level of education include:

- i. generating interest in mathematics and providing a solid foundation level for everyday living
- ii. developing of computational skills in students;
- iii. fostering the desire and ability of accuracy to a problem at hand;

- iv. development of accurate, logical and abstract thinking;
- v. development of ability to recognize problems and solve them with related mathematical knowledge;
- vi. provision of necessary mathematical background for further education;
- vii. stimulation and encouragement of creativity (Badmus, 1997, pg 56-57).

In spite of the objectives and premium position occupied by mathematics at the upper basic level of education it is disheartening to note that there has not been a remarkable improvement in the students' performance as corroborated by Olaoye (2004) and Odubunmi (2006). Ojinba, (2012) also submitted that WAEC report on core mathematics performance of students in Nigeria has not been encouraging. Many students have had the unpleasant situation of not being admitted to the tertiary institutions in Nigeria due to their inability to get the required grade in Core mathematics. This is because core mathematics forms one of the requirements needed for selection and placement for the various programmes in the secondary schools. As a result, a number of students resort to extra classes to better their grades in the subject with its additional cost of tuition.

Therefore, many wonder what could be done to salvage the situation as this has led to a number of researchers trying to find antidote to this menace. There are a number of reasons assigned to why students perform poorly and one among them is that, students are not practicing peer-assessment in the schools which is believed helps to improve students' performance. It therefore, becomes important to research into this factor with its peculiarity in this current study since most of the findings were inconclusive. Again, the level and characteristics of students' in this study is different therefore, this study is design to look at the effects that peer-assessment has on the achievement of these crops of students in this part of the world.

Purpose of the Study

The purpose of the study was to investigate effects of peer -assessment on upper basic students' mathematics achievement in Ilorin, Nigeria

Research Questions

- i. What is the perception of students' view about peer-assessment
- ii. To what extent does peer-assessment has influence on students' Mathematics achievement? •
- iii. Does peer-assessment has influence on students' Mathematics achievement based on gender?
- iv. What is the interaction effect of peer-assessment and gender on students' Mathematics achievement?

Hypotheses

- i. There is no significant effect of peer-assessment on students' mathematics achievement
- ii. There is no significant effect of peer-assessment on students' achievement based on
- iii. gender
- iv. There is no significant interaction effect of gender and peer-assessment skills on students mathematics achievement.

Methodology

The study adopted a mixed method design made up of quasi-experimental design and convergent parallel approach (i.e. parallel-databases design). The parallel-databases design was used to ensure level of interaction between the data collected from both quantitative and qualitative sources. Qualitative research involves interpretive, naturalistic approach to obtaining and analyzing data on a subject matter. This also involves understanding of human behavior and the reasons that govern such behavior which requires asking broad questions and collecting data in the form of words, images, videos etc. (Owolabi 2016)

The target population for the study consisted of all public upper basic schools (JHS) in Ilorin, Nigeria. From the 52 upper basic schools two of the schools were randomly selected (one for experimental and the other for control group). Approval was sought from the Principals of the upper basic schools to allow the researchers to use their schools for the study and subsequently collect data from the two schools. A module for teaching peer-assessment skills was developed by the researchers. Four weeks was used for the teaching and collection of data. The instruments for the data collection were peer- assessment questionnaire and mathematics test items. They were subjected to face and content validity while a test-retest method was used to determine the reliability of the mathematics test items (MTI). A peer- assessment open ended questionnaire (PAOEQ) was developed to seek the views of students on peer assessment skills. A pilot study involving 40 students in another public senior high school

in the same state at an interval of two weeks was done to establish the reliability of the instrument. The reliability coefficient of MTI was calculated to be 0.75. A face and content validity was established for the PAOEQ from some senior members of the Department of Social Science Education, University of Ilorin and also measurement and evaluation experts. The test statistic used in the analysis of the research questions was the thematic analysis and that for the hypotheses were ANCOVA

Results

Research Question **One**: What is the perception of students' view about peer-assessment?

Student Understanding and the Importance of Peer-Assessment

Generally, students' responses from the questionnaire indicated that they had fair knowledge and understanding of peer assessment as a concept. As one stated:

when you mark your colleagues or classmates test, work and assignment

Another remarked:

when we exchange quiz, assignment, class work for marking among ourselves as students

The result of the study showed that students at least know the benefits of peer-assessment. The students indicated that peer assessment encourages competition among them since they have the opportunity to see each other's marks. They also indicated that it helps them to understand the marking processes and thereby learn from their mistakes. Some said that it develops their accuracy skills and also gives them more opportunity to improve their work greatly.

A student response to this is;

So as to be able to correct my friend wrongs and also given me the skills in future teaching vocation

Research Question **2**: To what extent does peer-assessment has influence on students' Mathematics achievement

Confidence and Motivation of students

The result of the study showed that students had confident in their peer assessment scores. Ninety percent of the students expressed their total support to the marks that their peers gave them. However, 8% disagreed while 2% said sometimes agree. Some of the students also expressed their happiness in assessing their colleagues work and that it served as a source of motivation to them. Though it was indicated from their responses that they lacked the skills of peer-assessment but they were ready to learn. Among the 8% who said no to the confident they had in their colleague's score, one indicated:

Sometimes, people complain that I'm wrong in awarding certain marks and that is right and I usually have to confirm from my teacher

Another student said:

*it helps some and harm others so I cannot say yes is good and no is not good,
It makes your colleague make fun of you if she/he sees your mark if you fail.*

Academic Improvement

The result from the students' responses indicated that their academic achievement has improved after they were taken through the peer-assessment skills training. They actually recommended that this skill should be an integral part of the teaching and learning process in their school. Some indicated that it has helped them to know more of the subject and the steps involve in solving a question. They also indicated that it has improved their academic work because they learn from their mistakes. It also makes them to learn effectively.

A student remarked:

this skill training has helped me to ask from my peers where I made mistake, why that mistake and the way forward so it has really help me to improve my mathematics performance.

However, one student indicated that:

the skill should not be incorporated into the school system because naturally it will make some teachers lazy since they will be shifting their work load to the students.

Table 1: Descriptive Statistics of the Study Participants

Group	Gender	Mean	Std. Deviation	N
Experimental	Male	81.6667	8.57493	18
	Female	82.6316	8.71914	19
	Total	82.1622	8.54242	37
Control	Male	36.0870	12.24341	23
	Female	39.2857	9.97249	14
	Total	37.2973	11.40143	37
Total	Male	56.0976	25.26144	41
	Female	64.2424	23.58897	33
	Total	59.7297	24.70223	74

Table 1 shows the distribution of study participants based on group and gender. Thirty-seven (37) students constituted the experimental group made up of 18 males and 19 females. While the control group was also 37 but made up of 23 males and 14 females. In all, 74 students constituted the sample size for the study.

Hypothesis 3: *There is no significant effect of peer-assessment on students' mathematics achievement*

An analysis of covariance was conducted to explore the effect of peer-assessment on students' mathematics achievement between the experimental and control group in Table 2.

Table 2: ANCOVA Analysis of Effect of Peer-Assessment on Students' Mathematics Achievement

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	37373.748 ^a	4	9343.437	89.905	.000	.839
Intercept	3838.398	1	3838.398	36.934	.000	.349
PRETEST	38.258	1	38.258	.368	.546	.005
GROUP	35140.961	1	35140.961	338.137	.000	.831
GENDER	82.267	1	82.267	.792	.377	.011
GROUP * GENDER	24.151	1	24.151	.232	.631	.003
Error	7170.846	69	103.925			
Total	308550.000	74				
Corrected Total	44544.595	73				

a. R Squared = .839 (Adjusted R Squared = .830)

Table 2 revealed a statistical significant effect of peer assessment on students' mathematics achievement at the $p < 0.05$ with groups $F(1, 69) = 338.137$, $p = 0.000$. This indicates that the experimental groups with the higher mean of 82.1622 in mathematics as shown on Table 1 performed better in mathematics than the control group

Hypothesis 4: *There is no significant effect of peer-assessment on students' achievement based on gender*

Again, from Table 2 there was statistically no significant effect of peer-assessment on students' achievement based on gender, $F(1, 69) = .792$, $p = .377$. An indication is that gender does not have influence on students' mathematics achievement when peer-assessment is employed.

Hypothesis 5: *There is no significant interaction effect of gender and peer-assessment skills on students' mathematics achievement*

The interaction effect between gender and group was not statistically significant, $F(1, 69) = .232$, $p = .631$. This means that being male or female does not matter when considering an intervention such as peer-assessment skills training.

Discussion of the Results

The results from the ANCOVA analysis showed that peer-assessment is an effective teaching skill that can be used to improve students' performance in mathematics. Again, from the students' responses in the qualitative data analyzed it showed that indeed their performances have seen remarkably changed. Probably, this change came about as a result of treatment procedure administered to the students and also the students' desire and joy in marking their colleagues work. This finding is in support of Sadler and Good (2006) who used instructional rubrics as peer assessment tool for learning and that contributed to excellent performance among secondary school students. Also, this finding confirmed that of McMillan and Hearn (2008), who opined that, providing evaluation criteria through rubrics, models or anonymous exemplars helps students to concretely understand outcomes and expectations. It was also realized that gender does not play any role when designing an intervention such as this to enhance students' performance. Again, there was no interaction effect of gender and peer-assessment skills training as far as students' performances in mathematics is concern. This assertion was collaborated by the qualitative data analysed, both male and female students asserted that their performances in mathematics have improved due to the intervention they participated. Also 90% of the students from the qualitative data analysed said they trusted their peers' scores given to them. The finding of this study however, did not support the findings of Goodrich Andrade and Bonlay (2003) and Nelson and Schunn (2009), Goodrich and Bonlay (2003) conducted a study on writing performance when students were supported by rubrics and self-assessment and they reported positive effects only for some of the group investigated and the results sometimes differed between gender. Nelson and Schunn (2009) further showed that students were less likely to use peer assessment if they did not trust their peers' competencies. This study showed that students have fair idea about peer-assessment as a skill but did not have the required skills.

Conclusion

The findings of this study have shown a positive effect of peer-assessment skills training on students' mathematics achievement. In other words, peer-assessment as a teaching strategy is strongly related to the improvement of students' mathematics achievement. However, peer-assessment as a teaching strategy does not discriminate between male and female students. This therefore also requires the commitment of teachers and curriculum developers to consider the place of peer-assessment as instructional strategy and a powerful mechanism for improving students' mathematics performances. The promotion of peer-assessment strategy will no doubt help to improve the students' low performance in mathematics in Ilorin and in the country at large.

Recommendations

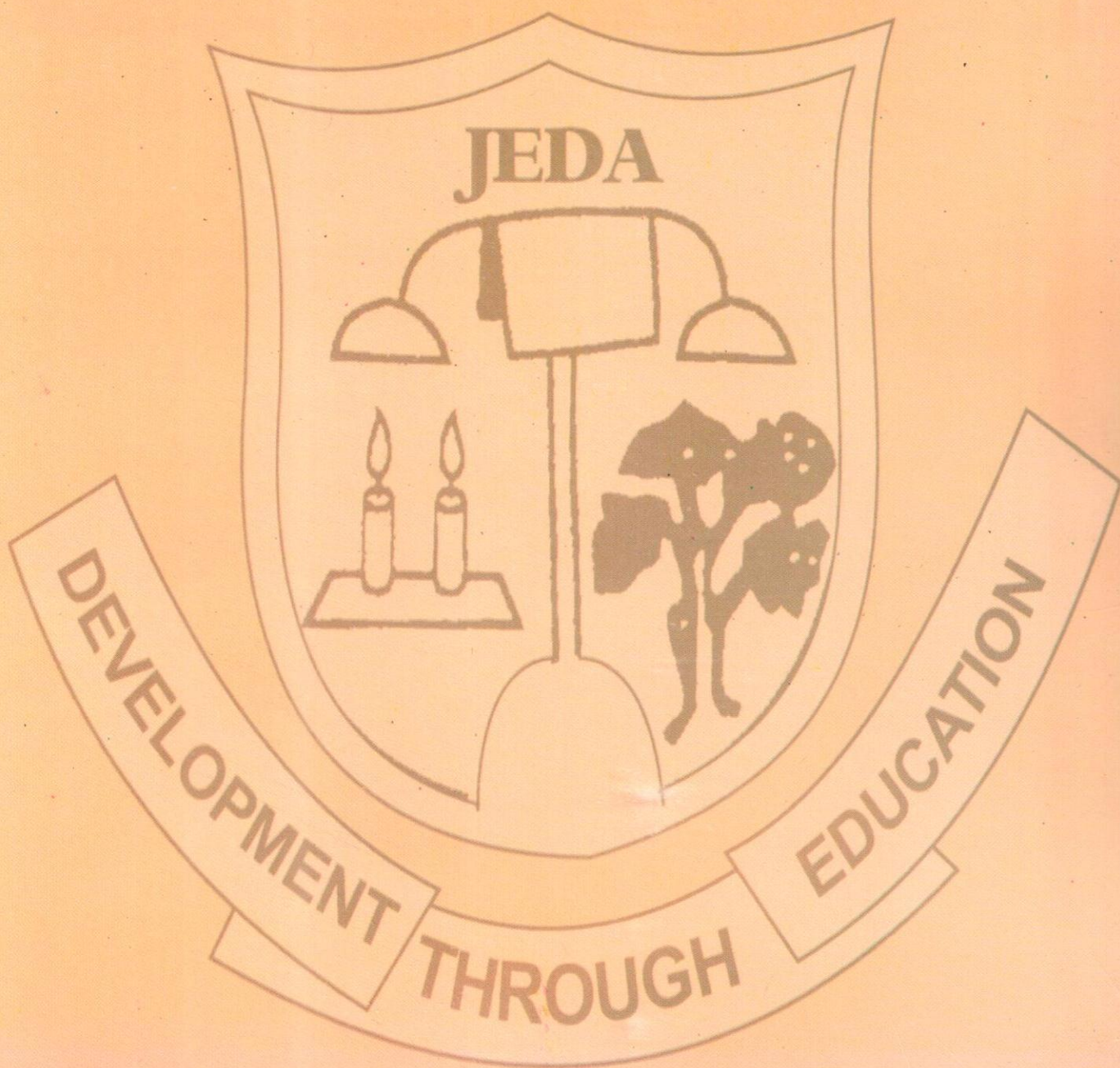
Based on the findings of this study the following recommendations were made;

- i. Teachers at the upper basic schools in Ilorin should be more familiar with the peer-assessment mode/strategy in order to incorporate it in their teaching
- ii. They should constantly attend workshops, seminars and train the trainers' conferences in the area of assessment (e.g. Peer-assessment) to update their knowledge.
- iii. Curriculum developers should try and advocate the use of such innovative assessment mode in the upper basic schools' curricula.

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