Interactive Radio Response (IRR) Effectiveness in Small-Class Size Chemistry Students Achievement

Abstract

The study examined the effectiveness of Interactive Radio Response (IRR) in teaching of small class size chemistry on student achievement in secondary school in Obiaruku, Ukwuani L.G.A., Delta State. One hundred and twenty (120) students randomly selected from five schools were enrolled for the study. Lessons relevant for the study prepared using prescribed textbooks in chemistry for students within SSII with and without IRR approach. Performance using students outcome were subjected to analysis using students' t-test from the raw score sheet. The results showed that a significant effect of IRR approach exist in small class-size chemistry teaching on students' academic achievement. Also, significant difference existed between mean scores for male and female students achievement using IRR approach in chemistry teaching of small class-size across secondary schools in the study area. The study concluded that IRR teaching approach on small class-size chemistry teaching has effect on students' achievement with male students' recording higher performance compared to their female counterparts. The study recommended that teachers should include IRR approach in small class-size chemistry teaching with no gender disparity to enhance students' academic performance.

Keywords: Achievement, chemistry, effectiveness, interactive radio response (IRR), small class-size

1. Introduction

Interactive Radio Response (IRR) is a means of curriculum content delivery through active interactions which occurs between radio characters, the teachers and students [1]. The IRR methodology is designed to shift focus from the typical teacher centered teaching approach to a more active methodology that engages teachers and the students in and outside the classroom setting. Countries across the globe have adopted the use of IRR in different subjects to improve quality of education. Over the years, IRR has been updated in various ways, its basic structure and methodology remain largely unaltered. Radio-delivered instruction enriches learners and learning environment by available resources such as classroom teachers, artifacts (songs, games), instructional materials available in classroom, including books and chalkboard [2].

Among such subjects included in radio response learning approach is Chemistry. The subject studies matter in forms such as structure, the composition and properties as well as changes it

undergoes. Chemistry is a pure science subject which studies the principles that governs changes in matter [3]. There is an interest in wanting to know what matter is what properties matter has that makes it useful and how matter can be changed from one form into another. Chemistry is divided into analytical, biochemistry, biotechnology, organic chemistry and physical chemistry [4]. Understanding the subject is important as it helps to explain the world around us.

Teaching chemistry using radio response approach is affected by class size. Class size is the summation of students present during a particular lesson. According to Owoeye and Yara [5], class size is an important factor in learning environment. The number of students in a class has a relationship with the structural aspect of class-size. A small structure class size should house considerable small number of students. However, problem comes when the students' number outruns the structural carrying capacity of the class. According to Ehrenberg *et al* [6], the number of students present in a class influences the learning outcome. This factor has a way of affecting students interaction and engagement in classroom and social activities. According to Mokobia and Okoye [7], delivery of instruction is an important factor that is influenced by class size.

Imoke [8], deposed that effective and well-structured class size implies rational coordination of available infrastructures in relation to the number of students to attain high success in academic productivity. The comfort of observed by students and their teachers is paramount in the teaching and learning process. Ehrenberg *et al* [6], noted that disruptive class can affect the students, as a structurally big class with students' who are not actively participating might constitute learning barriers with unwanted talks. Noise and disruptive behaviour affect the nature of activity teachers can promote. It could affect the time a teacher is able to focus on individual students and their specify needs rather than on the group as a whole. Doyle [9], stated that the need and interest of students is the focus of modern day education.

Large class size calls for large volume of assessment marking and feedback might be affected. This is a major challenge, especially across public schools in Nigeria. In the face of large class size, instructors are upset with the workload and resort to traditional teaching and assessment method. Ehrenberg *et al* [6], stated that class size is not the same as students' / teachers ratio. It is the actual and total number of students present in a class at a given time. While students /

teachers ratio is a way to calculate the average class size and the discrepancy between the two can vary, depending on teachers' role and amount of time teachers spend in the class during the school day [10]. The means of determining the size of a class is not easy to judge. In a class were 20 students are registered to attend class/subject will vary in its capacity from day to day because all the students may not be present at all-time [6].

Chemistry is a subject which has variance in number of participating students, most especially during practical session. Hassan and Mustapha [11], stated that Chemistry is a unique science subjects at the senior secondary level of education. Chemistry students develops scientific habits that are applied to other areas of life. Such habit involves non-reliance on superstition use of critical thinking and respect for others perception [12].

1.1 The Study Problem

One major problem of education in Nigeria, most especially in the rural setting is class size. Classes are congested and students are either not comfortable or are distracted by activities by other students. This is one major hindrance and problem associated with teaching, most especially the use of interactive radio response (IRR) which has been designed as comprehensive multi-channel learning system comprising of written materials, teachers orientation and instructional activities. Consequently, there is scarce information on the use of IRR in relation to class size students chemistry achievement in Nigerian secondary schools. Hence, this study tends to uncover the importance of IRR on chemistry students achievement using small-class size. The current study tries to answer the questions; Does interactive radio response teaching approach have any effect on secondary students' academic achievement in chemistry using small class-size? Is there any difference in male and female achievement in chemistry using interactive radio response approach in small class-size?

1.2 Importance

The study would benefit the following stakeholders in Nigeria secondary education. Students, teachers in Chemistry teacher as well as other teachers, school administrators and educational board. First, students would gain knowledge from this study because the study would help them understand the effective of class size on their academic performance. Teacher on their part would get knowledge on how to manage their class size during chemistry practical for effective

academic achievement in secondary school. Also, school administrators and educational board would benefit from this study because the outcome of the students will help them plan effectively towards achievable chemistry practical curriculum.

1.3 Study Aim and Determinants

The study is therefore aimed at determining the effectiveness and gender performance in secondary school chemistry using the interactive radio response teaching approach in small class-size. The generalization of this study results is therefore limited to the determinants stated as follows:

- The study is limited to the effectiveness of interactive radio response and its impact on teaching small-class size chemistry.
- The level of academic achievement of students in terms of the outcome of students' academic achievements in chemistry within the selected schools
- the study is limited to male and female students offering chemistry within the grade chosen which hinders generalizing the results to all chemistry students

2. Related Literature

Ayeni [13] stated that student-teacher ratio have to be considered in chemistry class sessions as it is a measure of teachers workloads, resource availability and attention posed to students'. According to Moluayonge and Park [14], students' sometimes benefit or lose depending on the nature of a classroom. This also influences teacher's experience. A science instructor can target students' needs, finding creative ways of helping them understand what is being taught and learning to make connections and problem-solve for themselves. Teachers can devise hands-on experiments in which they work closely with students through a realistic simulation, or they can organize frequent trips to laboratories or other practical venues from which their students can learn. These approaches tend to be more feasible on a regular basis with a small group [14]. Teaching of small size classes enables the teachers to easily spot certain problems and to provide feedback aimed at identifying the specific needs of students [15]. Classroom control and management has also been affected highly by class-size [14].

Waheed [16] who studied teachers' reflection on IRR broadcast found out that teachers view IRR as focused on what he described as, "holistic development of the child covering all

developmental domains i.e. physical, social, emotional and cognitive." The teachers sampled also agreed that IRR contents were derived from the national curriculum. The teachers confirmed that IRR improved their knowledge of teaching methodology especially in English Studies in terms of phonetics and phonics and also improved on their skills to facilitate activity based lessons following the interactivity induced in the lessons through drama, group work, singing etc.

3. Method

3.1 *Sample*

This study sampled male and female chemistry students in Senior Secondary Class II (SSII) within Ukwuani L.G.A., Delta State. With one hundred and twenty (120) chemistry students' drawn from five secondary schools. The schools included in the study were chosen because the research assistant is directly from the study area and has direct contact with the school heads.

3.2 *Research Tools*

The researcher and research assistant who is an expert in the subject matter prepared relevant lessons using topics in chemistry within the class syllabus. The lessons comprised of call and response questions, discussion and participatory options. The researchers recorded the lessons within a period to allow response from participating students. The lesson was recorded and broadcast using radio system to the students enrolled for the research. The researchers also drafted question based on the lesson taught using radio response which were later administered to the students

3.3 *Procedure*

The study was carried out by the researchers using the following procedures:

- The lessons relevant for the study were prepared using prescribed textbooks and resources available for students within SSII.
- Appropriate guide on teaching chemistry was adopted following instructional plans on classroom behavior, teachers approach, question guide and student response.
- Pre-test was carried out following students achievement in previous chemistry lessons taught using conventional method within the same set of students enrolled for the study.
- Interactive radio response class was arranged and prepared lessons were taught using an audio device with utmost clarity and audibility.

- Students incorporated in the study were allowed at equal rate to participate, respond and react appropriately to the broadcast.
- Post-test was carried out on students based on the lessons taught using the interactive radio response approach.
- Both male and female were subjected to pre-test and post-test.
- Response of male and female students were collated combined and separately for both pre-test and post-test respectively.

3.4 *Test Validity*

The validity of the interactive radio response device and lessons were verified by specialized arbitrator as well as the research assistant. The instrument was further validated by experts in science curriculum as well as measurement and evaluation. Relevant modifications and language suitability were adjusted and structured based on experts recommendations.

3.5 *Test Reliability*

The reliability of the test instrument and radio broadcast were ascertained by applying same to a pilot sample of SSI students outside the study area. The researcher thus verified the consistency of the research tools by calculating the Cronbach alpha coefficient. The result gave coefficient value of 0.86. This value was considered acceptable for the study.

3.5 *Data Analysis*

The researcher questions were answered using mean and standard deviation. The hypotheses were analyzed with mean and t-test.

4. Results

The findings of the study are presented as follows:

Research Question 1: Does interactive radio response teaching approach have any effect on secondary students' academic achievement in chemistry using small class-size?

Table 1: Mean and Standard Deviation Between Posttest and Pretest of Small Class Size

Variables	**N**	$\bar{X}$	**SD**
Pretest	120	5.23	2.20
Posttest	120	8.23	4.65

From the table 1 above, since the mean and standard deviation score of pretest scores 5.23 and 2.20 is lesser than the posttest scores 8.23 and 4.65, there is a difference between the two test scores. This shows significant effect of IRR in small-class size chemistry on students' academic achievement in secondary school within the study area.

Research Question 2: Is there any difference in male and female achievement in chemistry using interactive radio response approach in small class-size?

Table 2: Mean and Standard Deviation Between Male and Female of Small Class Size

Gender (Posttest)	**N**	$\bar{X}$	**SD**
Male	80	9.34	3.02
Female	40	2.23	1.23

From the table 3 above, since the mean and standard deviation score of male 9.34 and 3.02 is greater than the female 2.23 and 1.23, there is a difference between male and female on mean scores in favour to male students. This shows a difference in mean scores of male and female students in terms of achievement using IRR approach in small class-size chemistry teaching in the study area.

4.1 *Testing of Research Hypotheses*

Hypothesis Ho_1: There is no significant effect of Interactive Radio Response in teaching chemistry in small class size on students' academic achievement in secondary school in Obiaruku.

Table 3: t-test Analysis of Students Achievement Between Posttest and Pretest Mean Scores of Small Class Size

Variables	**N**	$\bar{X}$	**SD**	**Df**	**t-cal**	**t-crit**	**Sign Level**	**Decision**
Pretest	120	5.23	2.20	118	2.323	1.967	0.05	Rejected
Posttest	120	8.23	4.65					

From table 3 above, it is revealed that the calculated t-test value of 2.323 is greater than the table value 1.967 at 0.05 level of significance, hence this hypothesis one is rejected. This implies a

significant effect of IRR approach in small class-size chemistry teaching on students' academic achievement in secondary school in Obiaruku.

Hypothesis Ho_2: There is no significant difference between male and female students achievement mean scores of Interactive Radio Response in teaching chemistry in small class size in secondary schools in Obiaruku.

Table 4: t-test Analysis of Achievement Mean Scores Between Male and Female Mean in Small Class Size on Students Achievement in Chemistry Exposed to Posttest

Gender	**N**	$\bar{X}$	**SD**	**Df**	**t-cal**	**t-crit**	**Sign Level**	**Decision**
Male	80	9.34	3.02	118	4.432	1.967	0.05	Rejected
Female	40	2.23	1.23					

From table 4 above, it is revealed that the calculated t-test value of 4.432 is greater than the table value 1.967 at 0.05 level of significance, hence hypothesis two is rejected. This implies a significant difference in mean scores of male and female students achievement using IRR approach in teaching chemistry in small class size across secondary schools in the study area.

4.2 *Discussion of the Results*

The researcher discussed the results of the study as follows;

The results revealed significant impacts of IRR approach in teaching chemistry in small class-size on the academic achievement of secondary school students' in Obiaruku, Ukwuani L.G.A., Delta State. This conforms with the work of Idoko and Gregory [17], who researched on how interactive radio response approach impacted on pupil achievement and reported similar results, the study thus stated that radio response impacted on pupils achievement as compared to conventional teaching method. The study also observed significant difference in male and female students achievement mean scores in chemistry using IRR teaching approach in small class-size within the study area. This result agreed with Asadullah [18] who observed differences in male and female performance of in chemistry using IRR teaching approach in small class-size with male students performing better. Contrary to this study is the result of Felix [19] who reported that IRR teaching approach had no significant effect on gender.

5. Conclusion

The study concluded that;

- Interactive Radio Response approach for small class-size chemistry teaching had effects on students achievement.
- Gender difference was observed with male students having higher achievement in terms of mean scores using IRR teaching approach in small class-size chemistry teaching.

5.1 *Recommendations*

The study recommends as follows;

- Teachers should include Interactive Radio Response approach in teaching chemistry in secondary schools.
- Adequate class-size in relation to students' population should be provided to enable effective use radio response teaching approach.
- Emphasis should be channeled towards gender with lesser performance to attain adequate and effective outcome of using radio response in teaching.
- Government should support by providing equipment relevant for Interactive Radio Response teaching in secondary schools.

Reference

1. Westbrook, J., Durrani, N., Brown, R., Orr, D., Pryor, J., Boddy, J. and Salvi, F. (2013). Pedagogy, Curriculum, Teaching Practices and Teacher Education in Developing Countries. Final Report. Education Rigorous Literature Review. Department for International Development. 151p.
2. Volda, E. and Lidon, L. (2017). The effectiveness of Interactive Radio Instruction (IRI) within selected Primary Schools in Region Number Four (4). Social Science Learning Education Journal 2:1-16.
3. Ojelade, I.A. (2015). Impacts of Integrating Practical Classes into the Teaching of Chemistry in Senior Secondary Schools. Advances in Social Sciences Research Journal 2(3):140-146.
4. Ernest, Z. (2013). What are the branches of chemistry and their definition? Downloaded at: https://socratic.org/questions/what-are-the-branches-of-chemistry-and-their-definition.
5. Owoeye, S. and Yara, J. (2011). Interactive Radio/Audio Interventions in Elementary Schools in Karnataka, India: A Policy Simulation Exercise, Global Development Network (GDN).
6. Ehrenberg, R.G., Brewer, D.J., Gamoran, A. and Willms, J. (2001). Class Size and Student Achievement. Psychological Science in the Public Interest 2(1).
7. Mokobia MO, Okoye NS (2011). Effect of class size on the teaching and learning of in secondary schools in Delta state, Nigeria. J. of Edu. and Policy, 3(1): 1 - 7.

8. Imoke, M.A. (2011). Final Report on Somali Interactive Radio instruction, Education DevelopmentCenter (EDC), Health Communication Capacity Collaborative (2013) Social Learning Theory - HC3 Research.
9. Doyle, G.A. (2014) Social Learning Theory, Madison Avenue, New York City, General Learning Press.
10. Nizam, K. and Bekir, C. (2015). The Impact of Number of Students per Teacher on Student Achievement. Procedia - Social and Behavioral Sciences 177:65-70
11. Hassan, L.G. and Mustapha, S. (2019). Chemistry education at a cross-road in Nigeria. Al-Hikmah Journal of Arts and Social Sciences Education 1(2):67-74.
12. Yumus, A. and Au, S. (2012). Interactive Radio Instruction: An update in the field, Education Development Center, USA.
13. Ayeni , I.P. (2019). Cutting the head as cure for headache: Exploring the economic impact of Niger Delta militancy on host communities. *Journal of Interdisciplinary Studies* **1**(1):76-84.
14. Moluayonge, M. and Park, I. (2017). Effect of Challenges with Class Size, Classroom Management and Availability of Instructional Resources on Science Teachers' Teaching Practices in Secondary Schools. Journal of Science Education 41(1):135-151.
15. Wilson, P. (2006). Old technology - New experience: Teachers' and pupils' reactions to Interactive Radio Instruction (IRI) in grade two mathematics classrooms in Guyana.
16. Waheed, A. (2013) Impact Assessment Report Interactive Radio Instruction, Grant Award Number (RFA2O12 — INO1 —F0006), Power Radio 99 FM, The Communicators (Pvt) Limited.
17. Idoko, F.U. and Gregory, H.E. (2020). Impact of Interactive Radio Instruction (IRI) on Achievement in Literacy and life Skills among Primary one Nomadic Pupil in North-West, Nigeria. *Journal of Critical Review* **7**(19):10150-10161.
18. Asadullah, P.A. (2005). Impact of the conflict between farmers and herdsmen on food production in the agroecological Zone-B of Benue State, Nigeria. *Journal of Interdisciplinary Studies* **1**(1):56-64.
19. Felix, K.O. (2016). Impact of Instructional Radio Delivery Mode on Academic Achievement of Distance Learning Students' in Computer Science. *US-China Education Review B* **6**(12):688-698.