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Development and Validation of Teaching Practice Evaluation Instrument for Assessing Chemistry Students' Teaching Skills

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The study was designed to develop and factorially validate an instrument for measuring teaching practice skills of chemistry student-teachers in University of Nigeria, Nsukka. Two research questions guided the study. The design of the study was instrumentation. All the chemistry student-teachers in the Department of Science Education, University of Nigeria, Nsukka, involved in teaching practice in November 2011 formed the population for the study. No sampling technique was used as all the population formed the sample for the study. The instrument known as TPEF (teaching practice evaluation form) was developed. It was used to collect data for answering the research questions. The instrument was face validated and subjected to factor analysis using rotated component matrix to establish the construct validity. FL (factor loading) range of 0.35 and above (Meredith, 1969) was used for the extraction of the valid items. Internal consistency reliability coefficient of the instrument was established using Kendall's coefficient of concordance. The result of the analysis shows that TPEF was valid and reliable. It also shows that there was agreement among the raters. Based on these findings, the educational implications were discussed and recommendations made including that teachers in tertiary institutions should use this instrument in assessing chemistry student-teachers during their teaching practice due to its validity and reliability in assessing teaching practice skills in chemistry.

Keywords: factorial, validation, teaching practice, evaluation, chemistry student-teachers, human resources, education and universities

Introduction

Vision 20-2020 of the Federal Government of Nigeria is seen as a pragmatic step take to guide the nation's course of scientific and technological development towards making Nigeria one of the best 20 world economies by the year 2020. Nigeria cannot achieve this without developing her human resources. This is because there must be relevant manpower to harness natural and human resources. Education is the best instrument for achieving the above mentioned goals. It is, therefore, very important that quality teachers should be prepared for this crucial role of human capital development. No wonder teaching as a profession is receiving recognition all over the world. The abilities of teachers are crucial determinants of the quality of education in any nation. Also, incompetent teachers may not help in training the youths to meet the challenges of modern life, hence, the technological growth of the nation suffers. The National Policy of Education (FRN (Federal Republic of

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Nigeria), 2004) stipulated that, no educational system can rise the quality of its teachers. Therefore, teachers ought to be sufficiently prepared to meet the modern demands of the teaching and learning processes.

Historical development of teacher education in Nigeria dates back to the colonial era when there was no specific institution for the training secondary school teachers (Mgbako-Ezennia, 1992). What existed were only institutions for preparing primary school teachers. As these primary school teachers with experience were promoted to Grade 1 they were sent to secondary schools to teach. Later, science graduates from colleges of arts, science, and technology and universities were posted to secondary schools to teach chemistry without prerequisite professional training. Presently, the National Policy on Education (FRN, 2004) stipulated that only graduates from faculties of education in universities are qualified to teach chemistry at the secondary school level.

Secondary school education constitutes a crucial stage in the preparation of manpower for technological and scientific advancement (Mgbako-Ezennia, 1992). Coupled with unemployment rate in the nation, the secondary school products must be guided and equipped with entrepreneurial skills and attitudes needed for self-employment. Chemistry is an important science subject that has much influence in enhancing entrepreneurial skills and attitudes (Ezeudu, 2008a; 2008b). Its importance in other fields of life cannot also be overemphasized. The obvious questions to be answered are: Are the methodological skills acquired by the chemistry teachers enough to successfully implement the national policy on education so as to produce youths that can push this nation forward technological and be self-sustained in life? Is Nigerian chemistry teachers' preparation able to produce highly personality and skilled teachers needed for effective teaching of chemistry in the secondary schools? Are the chemistry teachers prepared emphasizing quantity rather than quality and making a living rather than making a life? This latter question is very crucial because many people move into the teaching profession for the sole reason of making a living. Colleges of education and faculties of education of universities should prepare teachers with right attitudes, values, skills, and personalities needed for effective performance in the teaching profession. Since it is obvious that without quality teachers, the goals of the National Policy on Education (FRN, 2004) cannot be achieved and the Vision 20-2020 will not be actualized, then there is the need to look into the evaluation format used to assess chemistry student-teachers. This will ensure that quality chemistry teachers will go to the secondary schools to teach. It is, therefore, in order to produce quality chemistry teachers that this paper sought to develop and factorial validates TPEF (teaching practice evaluation form) for assessment of teaching practice skills of chemistry student-teachers.

Chemistry student-teachers in universities do their teaching practice in secondary schools with the sole aim of preparing for the teaching profession. Teaching practice occupies a very important position in teacher education programme in universities in Nigeria. Prior to the teaching practice exercise, students do micro-teaching as a course work. Also, they must have been taught how to write lesson notes and lesson plans. Micro-teaching is videoed to enable student-teachers self-evaluate their performances and progress. On posting, student-teachers firstly familiarize themselves with the schools and the principals. They are then assigned to classes. They then see the class teacher who will give them the scheme of work to be covered within the stipulated time. They learn from the class teachers, information about the ages of the students, specific problems of the students, abilities of the students, textbooks to be used, teaching aids required, and the timetable to be followed.

The student-teacher now prepares his/her lessons. This is where all that he/she learned theoretically are placed into practice. He/she must learn to write a good lesson plan that must involve the students, must be

interesting, putting effectively the teaching methods, teaching strategies, and instructional aids within the specified time. In preparation, he/she must make efforts to plan how to take care of individual differences of the students, giving assignments. The next stage is the teaching in the classroom and this is the teaching practice stage. This stage has steps. With appropriate comportment and the use of clear voice and appropriate languages, the student-teacher goes through introduction, presentation, assessment of his/her lesson, gives class work and assessments and marks them. He/she learns to draw back and evaluate his/her chalkboard writings and the visibility of his/her teaching aids to the students at the back of the classroom. The evaluation of the lesson would provide information to his/her success of the lesson, i.e., whether the specific objectives are achieved. Classroom teaching is not the only job of a teacher and so student-teachers should be trained by other teachers in the field in other activities which will prepare them for the future job ahead. Firstly, they should learn to be in school for a whole day. They should take part in all activities of the school like conducting morning assembly, sports/games, maintenance of chemistry laboratory, library, class register, and other boards. They should be involved in the preparation of timetable, sports, school clubs like debates, science quiz, etc.. They should pick up responsibilities of being a class teacher or day master which will involve activities during prep time. They should learn to prepare question papers for examinations, conduct examinations, mark the scripts, compile results, and enter marks in the students' report books.

As the student-teachers grow through experiences, they are visited by supervisors. The supervisors observe their lesson plans, give pre-supervision discussions that are meant to relax, create friendly environment, and give professional guides to the student-teachers. The supervisor now observes the student-teachers in the classroom noting the punctuality, introduction, presentations, evaluations, application of these (teaching methods, strategies, and aids), the composure, clarity of voice, the dress, the students' interest, the interaction of the students, the use of the chalkboard, and the attainment of the objectives. The supervisor not only evaluates the teaching during the lesson, but also guides and counsels the student-teachers. After the classroom teaching, the supervisor meets with the student-teachers for an exit interview involving a feedback in the whole exercise. The supervisor identifies the problems confronting each student and helps in solving them.

It is the evaluation of the teaching practice by the supervisor that motivates the researcher to develop and factorially validate an instrument for evaluating teaching practice of chemistry student teachers. Actually, there are evaluation forms available at the colleges of education and faculties of education of the universities but to the researcher's knowledge there is non-specifically made to evaluate chemistry student-teachers.

Instrument development is one of the essential processes of educational measurement and evaluation (Nworgu, 1992). This work is an instrumentation research which aims at developing an instrument for measuring the behavour of chemistry student-teachers while on the teaching practice. Some researchers have developed and validated some instruments. Ugwu (2009) developed and validated an instrument for the assessment of process skills acquisition in practical chemistry. Ezeanya (2004) developed and preliminarily validated a CAT (chemistry achievement test) for senior secondary schools. Most of these instruments were developed from chemistry content but none was done on the teachers' preparation.

Statement of the Problem

Teaching practice is an activity which aims at preparing quality teachers. It is very necessary for prospective teachers to grow in the profession. It provides the opportunity for student-teachers to grow in the profession. Because of these vital role played by the teaching practice in the preparation of quality teachers,

it becomes necessary that an appropriate format for the evaluation of chemistry student-teachers should be developed and validated. The need also arises, because to the researcher's knowledge, there is no evaluation form specifically developed for the chemistry student-teachers. Most teacher training institutions in Nigeria do not engage in micro-teaching for their students. Some do not video-filmed them and allow the student-teachers to grow through their own evaluation. The consequences of these are the responsibilities of the supervisors to see to their acquisition of professional skills are enormous. Above all, teaching practice score contributes to the overall score for graduation in the university. It carries a lot of load which is six credits and this is one of the highest credit loads. The supervisors are not serious and no particular guide has been used. Some scorers are meticulous while others do not go for supervision but give marks from their office. Considering the importance of teaching practice to the overall teaching career of students and its importance in human capital development, the researchers considered it necessary to develop an instrument that will guide supervisors to assess students' appropriate behaviors and uniformity. This work, therefore, sought to develop and factorially validate an instrument for evaluating teaching practice skills for chemistry student-teachers in universities in Nigeria.

Research Questions

The research questions are as follows:

(1) What is the construct validity of the instrument—TPEF developed?

(2) What is the inter-rater reliability coefficient of the instrument—TPEF?

This is an instrumentation research design, because it aims at developing and validating an instrument for assessing teaching practice skills of chemistry student-teachers in universities in Nigeria.

The area of the study is University of Nigeria, Nsukka, Enugu State, Nigeria. The choice of this area is proximity to the researchers and for effective control of the raters.

The population of the study consisted of five chemistry student-teachers in the Department of Science Education, University of Nigeria, Nsukka, involved in teaching practice in November, 2011.

For the sample and sampling technique, all the student-teachers (as mentioned in the population) were used for the study and so there was no sampling technique adopted.

The instrument for data collection was TPEF which was developed by the researchers. The researchers went through the existing teaching practice forms used in assessing teaching practice in universities and drafted the instrument. The researchers took the instrument to some experienced chemistry teachers in higher institutions, some experts in science education, and some measurement and evaluation experts who gave some advice and made some comments on the instrument. Their comments helped to restructure the TPEF.

The instrument was trial tested on five chemistry student-teachers in the Department of Science Education, University of Nigeria, Nsukka doing the teaching practice in May 2010. Five lecturers from science education rated the students using TPEF during the teaching practice. The scores of the lecturers were used to establish the validity of the instrument and the inter-rater reliability coefficient of the instrument.

The data collected were analyzed based on each research question. Research question 1 was answered using factor analysis while Kendall's coefficient of concordance was used to answer research question 2.

Results

Research question 1: What is the construct validity of the instrument—TPEF developed?

Table 1

Summary of Factor Analysis of the Items of TPEF and Factor Loadings

		Rotated component matrix[a]		Component			
		1	2	Impure items	Complex items	Total No. of items selected	Total No. of items not settled
Teacher's personality	Item 1	0.499	0.072	-	-	3	-
	Item 2	0.633	0.230				
	Item 3	0.142	0.473				
	Item 4	0.053	0.409				
	Item 5	-0.149	0.669				
	Item 6	-0.023	0.787				
Preparation	Item 7	-0.027	0.666	-	-	6	-
	Item 8	0.462	0.330				
	Item 9	0.573	0.296				
	Item 10	0.075	0.488				
Presentation	Item 11	0.542	0.060	1	-	11	1
	Item 12	0.280	0.695				
	Item 13	0.604	0.273				
	Item 14	0.625	0.282				
	Item 15	0.448	0.292				
	Item 16	0.417	0.157				
	Item 17	0.818	0.068				
	Item 18	0.182	0.338				
	Item 19	0.139	0.403				
	Item 20	0.250	0.596				
	Item 21	0.370	-0.013				
	Item 22	0.757	-0.056				
	Item 23	0.527	-0.084				
Class management	Item 24	0.505	0.401	-	1	3	1
	Item 25	0.615	0.049				
Communication skills	Item 26	0.178	0.322	2	-	-	2
	Item 27	0.276	0.326				
	Item 28	0.141	0.778				
Evaluation	Item 29	0.433	0.214	-	-		
Total				3	1	25	4

Notes. Extraction method: Principal component analysis; Rotation method: Varimax with Kaiser normalization; [a] Rotated Component Matrix is one of the ways of running factor analysis. It is done by subjecting your scores to computer for analysis.

It is important to note that:

(1) FL (factor loading) range used in selection is 0.35 and above (Meredith, 1969);

(2) Items without any FL up to 0.35 is considered factorial impure and not selected;

(3) Any item with FL of 0.35 and above on more than one factor is considered factorial complex and not selected.

Table 1 shows the summary of factor analysis of which rotated component matrix shown in Appendix. From Table 1, a total of three items were impure, one item was complex, and 25 items were selected.

A total of 25 items were selected for having FL of 0.35 and above. Items 18, 26, and 27 were not selected being factorial impure and item 24 was not selected for being factorial complex. Thus, four items were not selected.

Research question 2: What is the inter-rater reliability coefficient of the instrument—TPEF developed?

Table 2

Kendall's Coefficient of Concordance Showing the Summary of Inter-rater Reliability Coefficient of TPEF

(1)

Rank	Mean rank
Item 1	19.20
Item 2	18.10
Item 3	15.52
Item 4	13.88
Item 5	13.98
Item 6	14.94
Item 7	10.70
Item 8	12.80
Item 9	9.88
Item 10	13.38
Item 11	15.84
Item 12	12.40
Item 13	15.80
Item 14	15.58
Item 15	11.10
Item 16	16.12
Item 17	20.54
Item 18	12.14
Item 19	14.32
Item 20	13.90
Item 21	12.10
Item 22	15.20
Item 23	16.58
Item 24	15.52
Item 25	14.42
Item 26	17.08
Item 27	18.14
Item 28	16.58
Item 29	19.26

(2)

Test statistics	
N	25
Kendall's *W*[a]	0.839
Chi-square	97.209
df	28
Asymp. sig.	0.072

Note. [a] Kendall's coefficient of concordance.

From Table 2, the Kendall's coefficient of concordance was 0.839. This is high indicating that there is agreement among the raters, and therefore, the instrument has score reliability.

Discussion

As shown in Table 1, the factorial validity (FLs) of the 25 items of TPEF ranges from 0.35 and above. This is an indication that the 25 items are valid to evaluate teaching practice skills of chemistry student teachers in tertiary institutions in Nigeria. This is in line with Meredith (1969) who recommended a FL of 0.36 and above as minimum for accepting any item as valid. This, therefore, implies that the items of TPEF are adequate and representative of the various constraints of chemistry student-teachers in respect to teaching practice skills. It means that skills acquired by chemistry student-teachers during the teaching practice can now be identified and scored.

The results of this study have shown that TPEF has high inter-rater reliability coefficients, and therefore, reliable and can be used to measure teaching practice skills. As shown in Table 2, the overall inter-rater reliability coefficient of all the factors of TPEF is 0.839. These values indicate that there is agreement in the scoring pattern of the five different scorers. This implies that teachers can use TPEF in scoring teaching practice skills of chemistry student-teachers without differences in their scores. In other words, the use of this instrument will help teachers score students on the skills acquired and the level of acquisition thereby finding out the extent of attainment of the goals of the teaching and invariably the effectiveness of the technique used. The inter-rater reliability coefficient of this instrument is considered adequate enough for use by teachers to effectively score chemistry students-teachers during the teaching practice without much difference in their scores.

Conclusion

The following conclusions are drawn from the findings of the study:

(1) The 25 items of TPEF were found valid for assessing chemistry student-teachers on teaching practice skills acquisition;

(2) The inter-rater reliability analysis of TPEF using Kendall's coefficient of concordance (*w*) indicates that TPEF has inter-rater reliability index of 0.839 indicating that there is agreement among the raters.

Educational Implications of the Findings

The findings of this study showed that the 25 items of TPEF are valid constructs with respect to skill acquisition of chemistry student-teachers during the teaching practice. This implies that the instrument has construct validity with respect to teaching practice skills and so can measure the skills exhibited by these students to an appreciable degree. It means that the skills exhibited by chemistry student-teachers can be identified and scored.

The implication to teachers is that when assessing skills exhibited by chemistry student-teachers, the teachers' choice of assessment instrument should be guided by the ability to the instrument to assess not only the product but the process that is involved in achieving the product, identifying and scoring the skills exhibited by the practicing teachers. This quality inherent to the instrument will help teachers to identify and score the skills exhibited by the student-teachers to an appreciable level of accuracy.

The fact that TPEF has high inter-rater reliability coefficient implies that they are consistent and reliable in measuring skills exhibited by chemistry student-teachers during the teaching practice. This, therefore, implies that teachers can adopt this instrument for uniformity and reliability of their results. Teachers should also learn the skills of developing instrument for evaluation knowing the importance of valid and reliable instrument.

Recommendations

Based on the findings of this study, the researchers recommend that:

(1) Teachers in tertiary institutions should adopt this instrument in assessing their chemistry student-teachers during their teaching practice;

(2) A training workshop could be organized for teachers in tertiary institutions on how to use the instrument to rate chemistry student-teachers during the teaching practice;

(3) Further studies should be done in other institutions where chemistry students are trained to develop instrument to assess their teaching practice skills.

References

Eau, C. (2010). *Teacher qualities*. University of Wisconsin. Retrieved May 2, 2012, from http://www.uwec.edu/career/students/jobsearch/teachrs/teachingqualities.htm

Eya, P. E., & Nze. (1999). *Methods in teaching.* Enugu: Pymonal Printing and Publishing Co..

Ezeanya. (2004). Development and preliminary validation of chemistry achievement test (CAT) for senior secondary schools (Unpublished M.Ed. thesis, University of Nigeria, Nsukka).

Ezeudu, F. O. (2008a). Restructuring our science, technology and mathematics (STM) education for entrepreneurship. *The 49th Annual Conference Proceedings of Science Teachers Association of Nigeria* (pp. 268-272), Science Teachers Association of Nigeria, Nigeria.

Ezeudu, F. O. (2008b) Entrepreneurial training as pre-retirement preparation for chemistry teachers. *Journal of Educational Foundations (JEF), 5*(1), 186-190.

FRN (Federal Republic of Nigeria). (2004). *National policy on education*. Lagos: NERDC Press.

Leadership skills. (2013). Retrieved from http://www.brianstormdynamics.com.customizable

Meredith, G. N. (1969). Dimensions of faculty of course evaluation. *Journal of Psychology, 73*, 27-32.

Mgbako-Ezennia, R. C. (1992). Teacher training for the secondary school system: Challenges beyond the 1990s. *The Nigerian Teachers Today, 1*(2), 34-39.

Nworgu, B. G. (1992). Theoretical foundations of achievement testing. In B. G. Nworgu (Ed.), *Educational measurement and evaluation: Theory and practice*. Nsukka: Hallman Publishers.

Ugwu, A. N. (2009). Development and validation of an instrument for the assessment of science process skills acquisition in practical chemistry (Unpublished Ph.D. dissertation, University of Nigeria, Nsukka).

Appendix

Department of Science Education,
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Teaching Practice Evaluation Form for Chemistry Students

Name of student: ---------- Reg. No.: ----------
Programme area: ---------- Year of study: ----------
School: ---------- Subject: ----------
Class: ---------- Topic taught: ----------
Duration: ---------- Date: ----------
Course code: ----------

Instruction

1. Observe the student-teacher and the pupils carefully during the lesson and complete this evaluation form while the lesson is going on by putting tick in the space at point which most closely indicates your view of the student-teacher’s performance.

2. Score only those numbered in alphabets.

Scoring Guide

S/N		1	2	3	4	5
1	Preparation					
a	Statement of objectives					
b	Adequacy of the content					
c	Synchronism of specific objectives & evaluation					
2	Presentation					
a	Introduction					
b	Development of lesson					
c	Teaching skills illustrated					
d	Use of chalkboard					
e	Utilization of teaching skills					
f	Effectiveness of teaching skills					
g	Effective organization of chalkboard					
h	Knowledge of the subject matter					
i	Questioning skills					
j	Use of instructional materials					
k	Class participation					
l	Student-teacher interaction					
3	Class management					
a	Class arrangement					
b	Class control					
c	Stimulation and motivation of students' interest					
d	Reinforcement of pupil's responses					
4	Communication skills					
a	Use of appropriate language					
b	Voice clarity					
5	Evaluation					
a	Suitability of assessment					
b	Attainment of stated objectives					
6	Teacher's personality					
a	Appearance					
b	Comportment					

Total score: ----------

Signature student-teacher: ----------

Comments: ----------

Supervisor's comments: ----------

Supervisor's name: ----------

Signature and date: ----------