NIGERIAN PRE-SERVICE SCIENCE TEACHERS' SELF-PERCEPTIONS OF ACQUIRED PEDAGOGICAL KNOWLEDGE AND SKILLS AFTER TEACHING PRACTICE EXPOSURE

Ayoade Ejiwale OKANLAWON

Osun State University at ipetu-Ijesa, NIGERIA

Abstract. The purposes of this study were to investigate the teaching competencies acquired and those not acquired by science teachers-in-training after exposure to teaching practice. The investigator used a fifty-six item questionnaire, labeled as Perception of the Acquired Pedagogical Knowledge and Skills Scale (PAPS), to elicit information from two hundred and ten pre-service science teachers in south-westgeo-political zone of Nigeria. A panel of five science educatorsdetermined the content validity of the questionnaire. The sample of science education undergraduates were drawn from three randomly selected universities using stratified random sampling technique. The pre-service teachers were required to rate their performance level on each teaching competence on a five-point Likert scale ranging from ‘‘high performance level’’ to ‘‘no performance level’’ with ‘‘average performance level’’ as the pivotal point of the scale. Following that, the mean of each competence item were computed. Any competence statement that had a mean rating of less

than 3.00 was considered to be of low performance cadre, since the mean value of the scale was 3.00. The findings of the study indicate that most of the teaching competencies that teachers-in-training have not acquired fall under theme 1 (planning instruction), theme 2(implementing instruction), theme 3 (evaluating instruction), and theme 7 (integrating technology and media in the classroom). The study also revealed that pre-service science teachers demonstrated proficiency in reinforcing learning, managing classroom, building professional links with colleagues and understanding learners' development. Based on the findings of this study, it was recommended that the principle of collaborative approaches for teacher learning should be incorporated into the teacher training program and that regular follow-up workshops aiming at developing Pedagogical Content Knowledge (PCK) of pre-service science teachers should be scheduled as needs arise.

Keywords: pre-service science teachers' self-perceptions, microteaching, teaching skills, practicum, teacher training programmes

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Introduction

Teaching as a profession has been described as the mother of all professions. In its noble goal of building up other professions, it has become the bedrock of national growth and development since no nation can rise above the quality of its teachers. It is therefore imperative that those involved in this business of teaching must possess the relevant knowledge and skills through adequate training to enable them meet the yearnings and expectations of all stakeholders in education.

Standard in teacher preparation for secondary schools can be set only when the teacher-trainees are groomed to become academically and pedagogically competent. When we speak of teacher competencies, what we mean is the competencies that make a teacher effective within the school and in the

classroom (Erden, 1998; O'Brien, 2008). Among the essential teachers` competencies in pedagogical literature are:(1) plans instruction at a variety of cognitive levels; (2) states students learning outcomes in behavioural terms; (3) identifies and evaluates learning problems of students; (4) know how to organise and use appropriate instructional materials; (5) uses a variety of instructional strategies; (6) uses convergent and divergent inquiry strategies; (7) establishes transition and sequences instructional activities that are varied; (8) modifies instructional activities to accommodate learner needs; (9) demonstrates ability to work with individual, small groups and large groups; (10) demonstrates knowledge in the subject areas. Thus, it is necessary for teacher training institutions to identify essential competencies and focus on student teachers acquisition of specific teaching skills. In Ortega's (2008) view, the principle of feedback is quite useful in developing teaching skills among student teachers and making them competent teachers by increasing their teaching competence. Research suggests that skill acquisition is supported when learners (i.e., student trainees) are asked to take active part in determining what they have acquired during practice and how they have acquired the expected skills (Ortega, 2008). The teacher training programme that aid this kind of metacognition include peer and self-assessment and reflection on one's progress and determining what needs further improvement is capable of producing high quality teachers (Henry et al., 2011).

In the colleges of education and faculties of education, teachers-in-training are exposed to theoretical concepts in subject methodology, educational psychology,educational sociology and classroom management. In addition, they were taught various philosophies dealing with educational practices. All these learnt concepts have to be applied successfully in real life situations during teaching practice. Before posting student teachers for teaching practice to different schools, they are assumed to have acquired different teaching skills during micro teaching session, extending over a week followed by

demonstration lessons given lecturer to make student teachers understand the integration if various skills and strategies in a 35-40 minutes lesson period. However, it is observed by teacher trainers (e.g., Park et al., 2010; Kauchak & Eggen, 2011) that student teachers are often limited in their repertoire of instructional strategies and many enter classrooms with minimal pedagogical knowledge and skills. Through trial and error, student teachers develop a repertoire of teaching strategies. This haphazard process of strategy development will not result in the production of high-quality teachers. Without high-quality training to prepare them for the challenges of theclassroom, student teachers will either teach as they have been taught or they fail to teach at all (Eggen & Kauchak, 2007).

Most studies on the teacher issue in Africa have been of the supply and demand type: usually involving estimates of required numbers (quantities) of teachers needed to match student enrolment, based on officially fixed or pedagogically determined teacher-student ratios. Such studies have tended to address two main types of challenges: teacher availability and distribution. Regrettably, we currently have limited understandings about quality dimension of teacher issues specifically on teacher preparation programme. Since quality teaching is a major determinant of quality learning outcomes as well as depends on well-trained and professional teachers, then aspect relating to teacher quality should be area of concern to all stakeholders in education. In a bid to expand knowledge, this study was undertaken to report pre-service science teachers' self-perception of acquired pedagogical knowledge and skills after exposure to teaching practice exercise. In doing so, the conduct of this study is guided by two research questions: (1) what are the competencies acquired by the student teachers based on their expressed perceptions; (2) what are the competencies that student teachers are in need of during teaching practice period?

Conceptual framework

Two bodies of literature jointly provided conceptual framework for this study. They are: (i) the concept of teaching competence; (ii) practicum.

The concept of teaching competence

The concept of competence is a complex one but within industrial context it simply means fitness to perform a specific task. In the literature, there exist other definitions of competence. As conceived by the Training Agency[1)] competence is refers to:

> …the ability to perform the activities within an occupation. Competence is a wider concept which embodies the ability to transfer skills and knowledge to new situations within the occupational area. It includes those qualities of personal effectiveness that are required in the work place to deal with co-workers, managers, and customers.

In the same perspective Miller et al. (1988) argued that competence may be equated with performance, and it is the ability to perform specific tasks. As viewed by Wolf (1989) competence is the ability to perform at agreed standards, incorporated in a statement of competence which specified the nature of the particular, performable occupational role. From teaching perspective, competence can be defined as the possession and development of sufficient skills, knowledge, appropriate attitudes and experience for successful performance in teaching tasks. Therefore, to become a competent teacher, a teacher must acquire the basic classroom skills needed to present and navigate their lessons. These basic teaching skills have been identified as: (1) *Lesson planning:* having clear cut objectives and an appropriate instructional sequence; (2) *Set induction:* the process of gaining student attention at the be-

ginning of the lesson; (3) *Presentation:* describing, demonstrating, explaining, narrating, giving appropriate illustrations and examples, guiding student practice, checking students understanding, making transitions from one task to another, planned repetition where necessary; (4) *Stimulus variation:* avoidance of boredom amongst students by gestures, movements, focusing, silence, changing sensory channels; (5) Proper use of audio-visual aids; (6) Effective integration of ICT into instruction; (7) *Reinforcement:* recognizing student difficulties, encouraging student participation and response: (8) *Questioning:* fluency in asking questions, posing questions and adapting questions; (9) Silence and nonverbal cues (body language); (10) Ending the lesson: method of concluding a teaching session so as to bring out the relevance of what has been learnt, its connection with past learning and its application to future learning

As observed,[2)] while there are numerous skills and understandings one needs to teach science effectively, four broad competencies have been identified as: (1) deep interconnected content knowledge, ability to "see" big ideas in curriculum and understand how to teach these big ideas; (2) ability to engage students in specialized classroom discourses aligned with reform goals; (3) understanding the full range of assessment strategies, purposes and contexts with which they should be used; (4) Understanding how to learn from one's practice.

Since teaching is a profession that requires specialized knowledge and skills, teachers in order to perform their jobs, should possess certain competencies specified earlier on. To acquire the basic teaching skills needed to present and navigate their lessons teachers should be given special training before starting their profession. Thus, teacher training involves the development of a repertoire of teaching skills, acquired through observing experienced teachers and often through practice teaching in a controlled setting using activities such

as microteaching or peer teaching. Good teaching from a training perspective is viewed as the master of a set of skills or competencies.

Practicum

One of the most important components of pre-service teacher training programme is practicum. It is often referred to as teaching practice. Practicum is also considered as the cornerstone of teacher education in the sense that it helps in bridging two world of theoretical and practice in teacher training for acquisition of basic teaching skills. There are two phases of practicum which include: (i) the preparation phase and (ii) the school-based experience phase.

At the preparation phase, the relationship between theory and practice is stressed through microteaching. It is through this phase that teachers-in-training have the opportunity to applying what they have been exposed to education courses (e.g., educational psychology, subject methodology, educational technology, curriculum and instruction).Microteaching is one of the efforts use by the pre-service teachers to transfer the knowledge and skills into action, and thus, they be try to bridge the gap between the theory and practice (Gurses et al., 2005). During microteaching pre-service teachers find opportunities to develop skills in planning for short- term, constructing specific learning objectives, selecting appropriate instructional strategies, learning activities and assessment techniques, asking questions and managing instructional time effectively.

The second phase, the school- based practicum experiences, is a phase during which learner teachers are introduce to the context of teaching profession. As identified by Goldhaber et al. (2011), three groups of personnel are usually involved in the school experience programme. These are: (1) student teachers who needs to have basic teaching skills as a result of their former exposure to microteaching; (2) cooperating teachers who possessed adequate pedagogical content knowledge as well as having in-depth knowledge of

school context; and (3) teaching practice supervisors (from the education faculty) who have an in-depth understanding of the practicum programme as well as familiar with the standard for evaluating student teachers' performance. The major purpose of the school- based practicum experience is to familiarize student teachers with the general school atmosphere and to develop in them some basic professional skills. It is expected that school-based experience phase should develop learner teachers to become confidence and competent as rapidly as possible through their classroom teaching, interaction with the school environment and more experienced cooperating teachers.

Methodology

A descriptive survey research design was adopted in this study. This design was used to obtain information from a sample of final year science education students about their self- perception of teaching competencies possessed and those not possessed by them using researcher designedquestionnaire.

The participants were 210 science education students at the final year class in different Nigeria universities. Their ages range from 19 to 24 years old. These students were drawn from three randomly selected universities in the western part of Nigeria. This sample of students was drawn from selected universities using stratified random sampling techniques. 60 specialized in mathematics education, 30 specialized in physics education, 81specialized in biology education, and 39 specialized in chemistry education.

The instrument for this study was a questionnaire developed by the researcher based on the suggestions described by Likert (1932) and Zurub & Rubba (1983). In constructing the questionnaire named as Perception of the Acquired Pedagogical Knowledge and Skills Scale (PAPS), care was taken to ensure that the content of items (competence statements) would be clearly understood by the respondents. Thus, these competence statements consisted of

simple sentences and the language was simple, clear and direct. The researcher also tries to ensure that initial list of 70 competence statements was meaningful to respondents. A panel of five lecturers in the department of Curriculum and Instructional Technology determined the content validity. This panel of judges was asked to: (a) evaluate whether the competence statements clearly indicate teaching competencies; (b) classify competence statements to one of the following thematic unities: Theme 1 (planning instruction), Theme 2 (Implementing instruction), Theme 3 (Reinforcing learning), Theme 4 (Evaluating instruction), Theme 5 (Managing classroom), Theme 6 (Understanding learners' development and individual differences, Theme 7 (Integrating technology and media into instruction), and Theme 8 (Building professional links with colleagues).

In accordance with the suggestions and comments of the validators the initial list of 70 competence sentences was reduced to 56. Thereafter, selected competence statements were then attached to a five-point Likert scale ranging from high performance level to no performance level with "average performance level as the pivotal point of the scale. Moving from "high performance level" to "no performance level", competence statements were scored from 5 to 1. A pilot study involving 120 university undergraduate science education students provided data from further validation and reliability determination of the instrument. The results of the pilot study revealed that the instrument is meaningful and it yielded a reliability coefficient of 0.87 through the application of spearman-Brown correlation formula.

Following reliability determination, the questionnaires were distributed to the sample a week after returning from the second phase of teaching practice exercise. Students were asked to rate each of the competence statements in terms of the level to which they have acquired the teaching competencies after exposure to teaching practice exercise.

The research computed the mean score and standard deviation for each teaching competence from the competency rating (1-5) assigned by student teachers. During computation, the mean rating by the teacher trainees on each competency was calculated. Any competency that had a mean rating of less than 3.00 was considered to be of low performance cadre, since the mean value of the scale was 3.00.

Results

Pre-service teachers' self-perception of acquired pedagogical knowledge and skills after exposure to teaching practice was analysed according to the themes used in designing questionnaire. Each competence statement was measured on five point rating scale. The findings of this study were presented in the following Tables.

Data in Table 1, indicated that student teachers rated themselves as incompetent on six out of the eight items (1-6) with their mean scores ranging from 1.02 to 1.66. They considered themselves as competent on two items (7, 8).

Table 1. Teaching competencies concerning planning instruction and pre-service science teachers' performance level on them

S/N	Theme 1: Planning instruction	X	SD	Decision
1	Divide scheme of work into daily lesson topics	1.60	0.67	Incompetent
2	Formulate instructional objectives to indicate learning behavior expected of learners after instruction	1.32	0.54	Incompetent
3	Design learning activities and assessment procedures that are truly aligned with learning objectives	1.02	0.39	Incompetent
4	Design lessons that would allow various learning objectives to be addressed	1.14	0.42	Incompetent
5	Plan for a variety of instructional materials to help students attain the learning objectives	1.66	0.69	Incompetent

6	Plan lessons in ways that consider the amount of time students need to effectively attain the planning objectives	1.20	0.51	Incompetent
7	Plan teaching activities to fit into the entire school plan	3.77	1.03	Competent
8	Demonstrate clear understanding of learning objectives	3.63	1.12	Competent

Data in Table 2 indicated that teacher trainees rated themselves as incompetent on eight out of ten items (10, 12-18) with their mean scores ranging from 1.25 to 2.82. They indicated high performance on two items (1, 11).

Table 2. Teaching competencies concerning implementing instruction and pre-service science teachers' performance level on them

S/N	Theme 2: implementing instruction	X	SD	Decision
9	Ensure that students understand the learning objectives set for them	3.15	1.08	Competent
10	Clear and accurately explain the procedure and content involved in the lesson	2.82	0.99	Incompetent
11	Present the subject matter in meaningful and relevant ways	3.35	1.17	Competent
12	Implement a variety of teaching- learning activities	2.21	0.56	Incompetent
13	Using varied instructional materials and learning resources	1.75	0.72	Incompetent
14	Encourage students to engage in higher order thinking in the classroom	1.46	0.69	Incompetent
15	Interact with students appropriately and encourage students to interact with each other	1.57	0.67	Incompetent
16	Build instruction on students' prior knowledge	2.82	1.08	Incompetent
17	Respond appropriately to student-generated questions	2.40	1.37	Incompetent
18	Adopt pedagogies that foster student involvement	1.25	0.75	Incompetent

Data in Table 3 revealed that the pre-service teachers expressed a high performance level on all competencies in theme 3 by their scoring of 3.41 and above.

Table 3. Teaching competencies concerning reinforcing learning and pre-servicescience teachers' performon them

S/N	Theme 3: reinforcing learning	X	SD	Decision
19	Assign challenging, but not too difficult work	4.42	0.76	Skill acquired
30	Make learning activities worthwhile	3.39	0.80	Skill acquired
21	Connect the learning task to the needs of the learners	3.39	0.58	Skill acquired
22	tie class activities to the learners' interest	3.45	3.63	Skill acquired
23	Explain connections between present learning and later life	3.66	0.56	Skill acquired
24	Provide incentives and rewards, if needed	4.34	0.85	Skill acquired
25	Avoid heavy emphasis on grading	3.41	0.77	Skill acquired

Data in Table 4 indicated that teachers-in-training rated themselves as incompetent on five out seven items (26 - 30) with their mean scores ranging from 1.33 to 2.63. They considered themselves as competent on two competencies (31, 32).

Table 4. Teaching competencies concerning evaluating instruction and pre-service science teachers' performancelevel on them

S/N	Theme 4: Evaluating instruction	X	SD	Decision
26	Construct test that measure a representative sample of the formulated learning objectives	2.53	0.93	Incompetent
27	Make students aware about their own progress and attainment of the learning objectives	2..63	1.44	Incompetent
28	Use test results to improve teaching and learning	1.71	0.65	Incompetent
29	Use a variety of evaluation devices and procedures (e.g., interview, portfolios)	1.33	0.52	Incompetent
30	Diagnosis students' learning problems using valid and reliable tests	1.42	0.69	Incompetent
31	Provide school administrators and parents with timely and reliable information about students' progress.	3.75	1.06	Competent
32	Keep accurate records of each student's progress	3.72	1.24	Competent

Data in Table 5 indicated that pre-service science teachers expressed a high performance level on four out of six items (33, 34, 36, 38) with their mean scores ranging from 3.67 to 3.81. They considered themselves as incompetent on two competencies (35, 37).

Table 5. Teaching competencies concerning managing classroom and pre-service science teachers' performance level on them

S/N	Theme 5: managing classroom	X	SD	Decision
33	Make good use of allotted instructional time	3.81	0.93	Competent
34	Ensuring that the physical environment is safe and conducive to learning	3.79	1.06	Competent
35	Set and enforce minimum expectations of behaviours	1.73	0.79	Incompetent
36	Identify courses of undesirablebehaviours and provide help for change	3.67	1.12	Competent
37	Ensure that any corrective measure fits both offense and offender	1.82	0.87	Incompetent
38	Respond to learning and behavioural problems quickly and appropriately	3.72	1.24	Competent

Data in Table 6 revealed that the pre-service science teachers expressed a high performance level on all competencies under theme 6 by their scoring of 3.60 and above.

Table 6. Teaching competencies concerning understating learners development and pre-service science teachers' performance level on them

S/N	Theme 6: understating learners development	X	SD	Decision
39	Consider the differences in backgrounds, experiences, and capacities of students in designing learning activities	3.95	1.03	Competent
40	Consider the differences in backgrounds and capabilities in formulating diverse and challenging learning objectives	3.99	1.03	Competent
41	Understand the physical and mental development of learners	3.60	1.03	Competent

Data in Table 7 indicated that the pre-service science teachers expressed a low performance level on all competencies under theme 7 with their mean values ranging from 1.36 to 2.82.

Table 7. Teaching competencies concerning integrating technology and media into instruction and pre-service science teachers' performance level on them

S/N	Theme 7: integrating technology and media into instruction	X	SD	Decision
42	Use a word processor for preparing basic documents (e.g. examination papers)	2.82	1.08	Incompetent
43	Use a spreadsheet for processing documents (e.g. mark sheets)	2.09	0.70	Incompetent
44	Use Power Point for classroom presentations	1.83	0.89	Incompetent
45	Use e-mail to communicate with other educators in professional matters	2.45	1.39	Incompetent
46	Design learning activities with ICT	1.73	0.65	Incompetent
47	Use the Worldwide Web to find information on educational matters	1.64	0.67	Incompetent
48	Evaluate the credibility of Web- based information	1.45	0.52	Incompetent
49	Integrate ICT based media into learning process	1.36	0.50	Incompetent
50	Manage technical breakdown during ICT usage.	1.45	0.67	Incompetent
51	Manage information storage systems	1.91	0.70	Incompetent
52	Select appropriate learning and instructional materials for teaching	1.63	0.80	Incompetent
53	Appropriate use of learning and instructional materials to achieve stated learning objectives	2.06	0.77	Incompetent
54	Improvise learning and instructional materials	2.45	1.37	Incompetent

Table 8. Teaching competencies concerning building professional links with colleagues and media into instruction and pre-service science teachers' performance level on them

S/N	Theme 8: professional links with colleagues	X	SD	Decision
55	Engaged other teachers in the same school in discussions to improve teaching practices	3.14	0.78	Competent
56	Participate in some professional teacher organizations that aims to improve teaching practices	3.02	1.02	Competent

Data in Table 8 revealed that the pre-service science teachers expressed a high performance level on all competencies under theme 8 by their scoring of 3.02 and above.

Discussion

Tables 1 to 8 contain the results of the study. Most of the teaching competencies that teachers-in-training are in need of during teaching practice period based on their expressed perception fall under the following themes: planning instruction, implementing instructionevaluating instruction, integratingtechnology and media into instruction. As revealed in Table 1, pre-service science teachers expressed a very low performance level on six competencies by scoring 1.66 and below on those competencies. Regrettably, these competencies had earlier been identified as being important for effective teaching of science by Freiberg & Driscoll (2002) and Ogonor & Badmus (2006). During instructional planning, teachers are expected to make decisions on the basis of learner, content, and context: who are my learners; what information, ideas, and concepts do I want my students to grasp; under what conditions will instruction occur; student teachers deficiencies in the area of instructional planning as reported in this study should be of serious concern for teacher trainers because if teachers-in-training are not highly competent in this regard, one wonders what type of curriculum content they would be able to teach. One plausible reason for this finding may be due to the fact that they had little or no previous experience to fall back on and less knowledge of their students and the curriculum contents and materials. As observed by Staiger & Rockoff (2010) new teachers spend much time planning instruction than experts do, often staying up late at night to plan the next day's lesson. Calderhead (1984) points out that what is "routine" to experience teachers are "conscious decisions" to novice teachers.

Based on the self-perception of student teachers, it was revealed that they demonstrated low performance level on eight competencies under implementing instruction (Table 2). This result coincides with the findings of Goodson (1992) who reported that one of the problems of beginning teachers is that they are typically asked to implement a curriculum that has been developed by others. In addition to learning to negotiate the school, a new role, and new students, beginning teachers must simultaneously implement an unfamiliar curriculum and also develop a teaching style that fit their particular context. Bantiwini (2010) expresses the potential dilemma this way: "At times the two demands are contradictory: the adopted curriculum prohibits establishing a satisfying role; and desired role makes it difficult to implement the established curriculum." Despite their low performance with regard to implementing instruction, they demonstrated sound knowledge of subject matter as indicated by their rating of 3.35 on item 11 (Table 2). Research indicates that the more teachers know about a content area, the more effective they are in teaching it (Kauchak & Eggen, 2011). Knowing a content area is well enough to pass semester examinations and being able to teach the contents require different kinds of knowledge, known as pedagogical content knowledge (PCK).

As shown in Table 4, most student teachers have a limited repertoire of assessing strategies and few prior experiences with alternative assessment as indicated by their low performance on five competencies. That is, items 26 to 30. Most beginning teachers only have experience with their assessment measures that their teachers used when they were students: multiple-choice, true/false and short-answer essay tests. Assessing students using alternative strategies like interview, observation and portfolios were unfamiliar to them.

Table 6 indicated that teacher trainees considered themselves to be competent concerning understanding learners' development and individual differences as higher ratings were given to items 39 to 41. Individuals are highly diverse and teachers should take note of this diversity when planning

instruction. Students differ from one another in aptitudes, learning styles, experiences, culture, and language skills. Reliable information about students' capabilities and their prior knowledge would enable teachers to differentiate instruction for specific students or to tailor instruction for a particular classroom group. Without appropriate consideration of individual differences in lesson plan and lesson delivery, teachers may try to teach in ways that are uniform and hence effective only for a few students. It should be noted that student learning is affected both by teacher's instructional strategies and by the level of treatment given to individual differences.

The findings presented in Table 3 show that student teachers from their rating were highly competent in reinforcing learning. The teachers-in-training indicated high performance on all the items (19-25) that fall under theme 3 (Table 3). Woolfolk et al. (2008) had earlier observed that four basic conditions must be in place before the influences which teacher might have upon learners, motivation to learn in a particular situation can be noticed. First, the classroom or learning environment must be fairly organized and free from constant interruptions. Seconds, the teacher needs to be patient and supportive, avoiding embarrassing learners for mistakes. Third, the classroom activity must be challenging but reasonable. The first two factors have to do with classroom management in which the teachers-in-training have demonstrated high competent to some reasonable degree as revealed in Table 5.

Table 7 indicated that teachers considered themselves as incompetent regarding integration of technology and media into classroom instruction. Teachers' professional development is a key factor to successful integration of ICT into teaching. Effective integration of ICT into classroom instructions requires acquisition of skills in the following areas: word processing (MS word) spreadsheet (Excel), presentation (PowerPoint), website navigation and Internet searching, e- mailing, and scanning text and graphics. Sandholtz & Reilly (2004) claim that teachers' technology skills are strong determinant of

ICT integration but they are not conditions for effective use of technology in the classroom. They argue that training programme that concentrated on ICT pedagogical training instead of technical issues and effective technical support, help teachers apply technologies in teaching and learning. As more technology is placed in school classrooms, the need for knowledgeable teachers to use these tools effectively becomes a pressing issue. Preparing future teachers who know how to integrate effective use of ICTs in their curriculum remains a challenging goal for teacher preparation programmes.

As depicted in Table 8, respondents were reported as highly competent regarding building professional links with colleagues, student teachers expressed a high performance level on two competencies by scorning 3.02 and 3-14. Making a link with the professional bodies will enable beginning teachers to meet their various career needs. Some of the needs that can be met through participating in professional association include: (1) having opportunities to share expertise with other experienced teachers and educators; (2) obtaining appropriate, up-to-date information on the content area of the subject and teaching methodology; and (3) having access to new research findings on pedagogy. It should be noted that unique induction by means of learning with colleagues and guidance by expert teacher educators can be an applicable model for professional development in teacher education if properly structured.

Interestingly the teachers-in-training indicated high performance level on four competencies by scoring 3.67 and above based on their ratings (Table 5). These competencies fall under theme 5 (managing classroom). Among other things, making good use of allotted instructional time, ensuring that the physical environment is safe and conducive to learning have earlier been reported by Watson & Battistich (2006) as elements of good classroom management. When the classroom climate is positive, the classroom can become a

learning community, a place in which the teacher and students work together to help everyone learn.

Worthy of special consideration is the finding of low performance level on two competencies under theme 5 which state that (i) set and enforce minimum expectations of behaviours which was rated 1.73 and (ii) ensure that any corrective measure fits both offense and offender which was rated 1.82. This finding has important implications for teacher training. During teacher training, teacher educators should emphasize that classroom management is more than discipline. It involves among other things, the development of classroom rules and rational consequences for breaking them. Class management also can be measured by the extent to which social justice triumphs over the "teacher's pet" concept and by a teacher's ability to share control and promote student self- discipline.

Conclusion

The study was conducted with a sample of pre-service science teachers. Therefore, we can only infer about their self-perception of acquired pedagogical knowledge and skills after teaching practice exposure and at the same time draw some implications that might improve teacher training programme. From the mean, given in Tables 1-8, the following conclusions are extracted:(a) teachers-in-training considered themselves to be incompetent regarding planning instruction, implementing instruction, evaluating instruction, and integrating technology into instruction; (b) teacher trainees considered themselves to be competent regarding reinforcing learning, managing classroom, understanding learners development and individual differencesand building professional links with colleagues. The findings of this study have some implications for teacher training programme. First, the finding calls for a review of the teacher training programme at the pre-service level where emphasis should as much as possible be placed on those competencies (e.g., instruction-

al planning) that they have not been acquired. Second, particular attention should be paid to the use of Information and Communication Technology (ICT) devices for science instruction.

Recommendations

Based on the findings of this study, the researcher makes the following five recommendations for improving teacher training programme.

(I) The principles of collaborative approaches for teacher learning should be incorporated into the practicum experiences of prospective teachers. A simplified description of this approach is explained as follows: (i) a group of teachers plans a lesson together; (ii) one person teaches, the others watch and write reviews; (iii) the lesson plan is revised after group discussion; (iv) a different teacher teaches others watch and write reviews.

(II). This process cycles through over and over. Concerted efforts should be made by teacher trainers in education faculties to design an outline library of experienced teachers can access for ideas and instructional development.

(III) Education faculties should establish a confidential online ``helpline`` to answer beginning teacher `questions relating to pedagogical issues.

(IV) Teacher training institutions in conjunction with government approved ITcentres should organise regular workshops on how to make technology an effective and integrated part of the teaching and learning process.

(V) Learning intervention aiming at improving classroom performance of teachers-in-training should be planned as needs arise.

NOTES

1. Development of accessible standards for national certification guidance: Note 1. Sheffield Employment Department: Training Agency, 1989.

2. Cultivating 21st century skills in science learners: how systems of teacher preparation and professional development will have to evolve. National Academies of Science Workshop, February, 2009.

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✉ Dr. Ayoade Ejiwale Okanlawon
Department of Science, Technology and Mathematics Education,
Osun State University at ipetu-Ijesa,
P.M.B 2007. IpetuIjesa. Nigeria.
E-mail: drokanla@gmail.com

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