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The Practices of Teacher Education Institutions (TEIs): Equipping the Pre Service Teachers with the Required Concepts and Skills

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ABSTRACT

Based on the premise that quality education demands effective teachers, this qualitative-quantitative study was pursued to determine the practices of Teacher Education Institutions (TEIs) that are capable of equipping the pre service teachers with the concepts and skills they need to become good teachers in basic education. A total of 25 faculty and 68 pre service teachers from four TEIs were the participants of the study. Standardized concept tests, science process skills tests, attitudinaire, classroom observation protocol, interview protocol and documentary analysis were utilized in the study. As a whole, enriched curricula and syllabi, a well implemented faculty development program and strict admission and retention policies are practices that can bring about the attainment of the implemented curriculum. The practices which resulted in the attainment of the planned and implemented curriculum are translated into policies and disseminated to all TEI's in the country.

Keywords: curriculum, practices, Science Education, Teacher Education Institution

Introduction

The quality of education in a country depends upon the quality of teachers produced by teacher education institutions (TEIs) hence the academic and professional training the pre service teachers get from the TEI should equip them with the theory and practice connections so that they will be able to deliver successfully when they become teachers.

Issues related to teacher quality and quality of teacher education is always a priority in a society committed to excellence. In the Philippines, the pre service training is provided by TEIs coordinated by the Commission on Higher Education (CHED). In recent years, the number of TEIs has increased and about 70 percent of them are private institutions. This situation resulted in the proliferation of low-quality programs that do not meet the minimum standards set by CHED. Only less than twenty percent of these HEIs have ventured into the national accreditation system. Poor program rationalization and low standards of higher education have strongly affected the quality of teachers produced by the TEIs.

At present, TEIs are not producing enough teachers to teach Science and Mathematics. This is compounded by the fact that many of the competent Science and Mathematics teachers have migrated to other countries because of better pay and better opportunities. Consequently, in order to build up a workforce of Science and Mathematics teachers, House Bill 3479, An Act Allowing Graduates in Science, Mathematics, Statistics and Engineering Courses to Teach Science and Mathematics in the Elementary and Secondary Levels.

In a survey on science courses, many Teacher Education Institutions (TEIs) are not able to offer specializations in biology, physics and chemistry (Ibe et al, 1998). While there are TEIs that are able to comply with the 40-45 unit-requirements for the science major courses (CMO 27), Golla and Guzman (1998) as cited by Limjap suggested that investigations have to be made on the extent by which specializations are offered in teacher education institutions.

Studies (Nebres & Intal, 1998; Ibe et al., 1998) revealed that students, at the start of their college education, can hardly appreciate introductory science courses because of teachers' practices of delivering these courses above or even beyond the grasp of most students. Consequently, students rarely choose a career in science teaching. Corollary to these findings and observations, Talisayon (1998) as cited by Limjap stated that science concepts, principles, generalizations and theories were passed on to the students to memorize, while problem solving consisted of a demonstration steps by the teacher which has to be followed by the students. Moreover, teachers feel more confident telling the students facts, and principles than facilitating learning, and getting students to develop and use science processes such as inferring, predicting and generalizing.

Hence, it is important to determine the practices of TEIs that can effectively equip the future teachers with concepts and skills they need to become good teachers.

Literature Review

Concerns of Teacher Education

In a study commissioned by CHED (2004), it was found that problems in teacher education started with the quality of recruits. The graduating students who belong to the lowest thirty percentile rank in the National Secondary Achievement Test (NSAT) opted for teacher education as a career path. Of those who enrolled in teacher education, 71 percent are able to complete the course. The other 29% usually drop out from the program, mostly due to economic problems or lack of preference for teacher education.

Of the prospective teachers enrolled in BSE degrees, only 1.5 percent chose mathematics or science as their major. Presently, there are four BSE science programs (general science, biology, chemistry and physics) and a single mathematics program. Majority of TEIs focus on non-science subjects. The only science course commonly offered as a major is general science which prepares the teacher for the first year science high school science curriculum. Programs which prepare teachers for specialized science (biology, chemistry and physics, taught in second, third and fourth years in the secondary level) are offered in a very few institutions, usually in the Centers of Excellence. This scenario has resulted in a shortage of teachers especially in physics and chemistry.

In addition, the National Commission on Teaching & America's Future (NCTAF) states that a strong body of empirical evidence coupled with rich professional experience showed that teaching and teacher education "mattered most" in improving school's achievement. The report identified key obstacles to creating a strong and professionalized teaching force: major flaws in traditional teacher education, slipshod recruitment and hiring patterns, continued tolerance for extraordinary turnover among new teachers, and little investment in teachers' professional development.

For quite a number of years already, there has been a growing dissatisfaction with "traditional" approaches in teacher education. U.S. Secretary of Education Rodney Paige (2002) in his first report to Congress on how the nation was meeting the 'highly qualified teachers' challenge, revealed that schools of education and formal teacher training programs are failing to produce the types of highly qualified teachers that the 'No Child Left Behind Act' demands.

The Secretary's second report (U.S. Department of Education 2003) was consistent with the first, calling for continued research on teacher quality and preparation that identify 'interventions' that will raise effectiveness for all teachers. In addition, a U.S. Department of Education commissioned research revealed a relationship between teacher education and effectiveness in controlled studies across units of analysis and measures of preparation. (Wilson, Floden and Ferrini- Mundy, 2001).

In studies conducted by Hofsten, A & V Lunetla, (2004), Costa, et.al (2000) and Perez, D. 2007, it was learned that many science education teachers need to be competent in using innovative methods to enhance student outcomes.

According to Darling-Hammond,(2006), if the nation's classrooms are to be filled with teachers who can teach ambitious skills to all learners, the solution must lie in large part with strong, universal teacher education which offers programs whose graduates are sought out by principals and superintendents because they prove consistently capable of creating successful classrooms and helping to lead successful schools.

In a case study of seven pre service teacher education programs identified as successful in preparing 'learner centered' and 'learning centered teachers', Darling-Hammond(2006) found out that the seven programs shared six common features: a shared, clear understanding among faculty, students and school personnel of good teaching that permeates all courses and field experiences: a clear set of practice and performance standards against which students' work is guided and evaluated: a curriculum with extensive work in child and adolescent development, learning theories and theories of cognition, motivation and subject matter pedagogy: carefully selected field experiences of at least 30 weeks that support the ideas in concurrent coursework: strong relationships and shared beliefs among school university based faculty and staff and extensive use of various pedagogical strategies that relate learning to real problems of practice.

Method

Participants

The participants of the study were 25 faculty members and 68 pre service teachers from four Teacher Education Institutions (three private and a government TEI). These pre service teachers were purposively selected from the graduating science majors of the four TEIs involved in the study. The faculty sample was the total faculty from the science department of the four TEIs.

Instruments

The planned, implemented and attained curriculum was explored in order to determine the effective practices that resulted to the attainment of the planned and implemented curriculum.
For the planned curriculum, teaching artifacts such as the curriculum of the Bachelor of Science in Education, course syllabi, records of faculty profile, faculty development plans and programs and policies on student recruitment, selection and retention were studied and analyzed.
The implemented curriculum was measured and described utilizing data gathered from observation of classes and interviews. Classroom Observation Protocol which was adapted from the Reformed Teacher Observation Protocol by the ACEPT Program, Arizona State University and the CETP Core Evaluation Protocol. Interview Protocols A and B were used to gather additional data on teaching resources, course content, instructional resources and other related concerns.
The attained curriculum described the outcomes of the planned and implemented curriculum as indicated by the mean scores of the pre service students in the Biology Concepts Inventory (BCI) for the biological science majors, Force Concepts Inventory (FCI) for the physics majors and the Chemical Concepts Inventory (CCI) for the chemistry majors. The Test of Basic and Science Process Skills and the Views about Science Teaching and Learning were also utilized.

Data Analysis

Both qualitative and quantitative and qualitative analyses were used in the study. Quantitative analysis was employed to extract common patterns of practices of TEIs. Quantitative data were analyzed to describe the pre service teachers' exit level competencies which became the basis in determining the effective practices of TEIs.

Results

Table 1 below present the information gathered regarding the planned, implemented and attained curriculum.

Table 1: The planned, implemented and attained curriculum of the participant institutions

	TEI 1	TEI 2	TEI 3	TEI 4
Planned Curriculum				
Gen ED	69	73	70	75
Prof Ed	60	49	69	36
Majorship	36	70	42	65
Total	165	192	181	176
• Syllabus	done by faculty handling the subject	developed by a pool of experts	done by the faculty handling the subject	done by subject experts
Teaching Strategies/Activities	Varied, both active and traditional strategies/activities	→	→	→
Assessment	Traditional and alternative forms of assessment	→	→	→
Faculty Profile				
Mean Age	50	38	33	42
Years of Exp.	23	17	13	17
PhD/Ed/D	1	1	1	4
Masters Degree	3	1	10	4
Faculty Development Program	w/ a five year dev't. program but not fully implemented .limited opportunities for advancement	w/ a five year development plan . fully implemented & with broad range of opportunities & benefits enjoyed by the faculty	w/ a five year dev't. program but not fully implemented .limited opportunities for advancement	w/ a five year development plan . fully implemented & with broad range of opportunities & benefits enjoyed by the faculty
Student selection scheme	Open admission but selective retention	Selective recruitment, admission, retention/dismissal policies are implemented	Open admission but selective retention	selective recruitment, admission, retention/ dismissal, policies are implemented

Implemented Curriculum				
Content knowledge				
Propositional	3.54	4.40	4.49	**4.8**
Procedural	3.08	4.50	4.28	**4.24**
Pedagogical	activities done and questions asked start from knowledge to more critical questions			
Assessment	Observed assessment tools are varied in all four TEIS			
Attained Curriculum				
BCI	11.29/30	18.01/30	12/30	16.72/30
CCI			8.08/22	14.00/22
FCI		18.37/27	12/27	
SPST	34.07/94	65 /94	36.79/94	56.31/94

Planned Curriculum

The BSEd science curricular programs of the four TEIs show that the average number of units for the majorship (53 units) is higher than the CHED required 36 units. General education constitutes 40 percent (72 out of 179 units) while only 30 percent (54 out of 179 units) were on professional education.For the total number of units, the highest is 192 while the lowest is 165.The data also reveal that TEIs 2 and 4 have higher number of units in majorship compared with those of TEI 1 and 3.

In preparing the course syllabi, the four institutions followed different strategies. For TEI 1 and TEI 3, the faculty handling the subject prepares the syllabus for the course. In TEI 2, there is a committee that cooperatively prepares it while in TEI 4, members of the faculty who are considered experts in their discipline were tasked to prepare and/or revise the syllabi.

On teaching strategies and activities, the lecture method ranked first among those strategies frequently mentioned in the course syllabi in science education. Aside from lecture, other strategies were included like problem-based jigsaw puzzle, case study method, laboratory method, demonstration, journal reading, practical work/test, guided inquiry followed field trips/outdoor activities project method and other activities- all of which require students to apply what they have learned inside the classroom. Further analysis of the course syllabi showed that some courses utilized only three (3) strategies; others utilized seven (7). Most of the courses employed at least five (5) teaching strategies.

On the other hand, the most common evaluation tools employed by the TEI faculty members were graded recitations and long examinations that include preliminary, midterm, and final exams. These examinations showed varied types of tests such as multiple choice, enhanced multiple choice, matching type, identification type, true or false, completion type, essays, label the diagram, and problem solving items. Long examinations, quizzes, graded recitation, lab report, and individual or group projects are the frequently used evaluation tools in biology. Other than those mentioned in biology, chemistry courses also employ problem sets and scientific readings.

As to the faculty profile, it was discovered that they are highly qualified and competent. They have PhD and Master's degrees in pure science and in science education. It seems that the teachers of the Science Department of the TEIs involved in the study have the required degrees which make them highly capable teachers of science education courses The mean age is 39 while the mean years of experience is 16.

For the faculty development program, it was found out that TEIs 2 and 4 support their faculty, academic staff and administrators in their ongoing quest for excellence in teaching, research, outreach, and leadership in teacher education. To assist and support faculty in their professional development, long-term faculty development programs were put in place, which aim to help faculty achieve their goals in the areas of teaching, research/creative work, and other professional activities to enrich student learning. A broad range of opportunities are enjoyed by the faculty members which include financial assistance and other privileges.

However, although TEIs 1 and 3 have a five-year development program, it is not fully implemented. A faculty seminar is conducted every year but the faculty members believe that this is not enough to develop a well-rounded and updated teacher. According to them, if ever faculty members are sent to attend local, regional or national seminars, these are very rare; hence the professional growth of the faculty becomes very limited.

As regards to student selection and retention scheme, TEI-2 and TEI-4 have admissions offices that implement strictly the selective recruitment, admission, as well as the retention/dismissal policies in both undergraduate and graduate levels to get the best available talents for teacher education. Their student applicants for incoming freshmen must pass a University Admissions Test, oral interview, and medical examination. The students have to maintain grades required by the institutions. Meanwhile, TEI-1 and TEI-3 apply open admission but selective retention policy. However, the faculty explained that although they have selective retention policy, this is not enforced hence even mediocre students or even students with below average performance were allowed to continue and finish the course. Some faculty mentioned that they often conduct intervention classes to help the weak students.

The Extent of Implementation of the Planned Curriculum

To determine the extent of implementation of the planned curriculum as demonstrated by the teaching practices of the TEI faculty members in Science Education, the following teaching components have been evaluated: content knowledge, teaching strategies, classroom activities, and assessment scheme.

Content Knowledge

Knowledge can be thought of as having two forms: knowledge of what is (propositional knowledge), and knowledge of how to perform some tasks (procedural knowledge). Propositional knowledge or declarative knowledge is knowledge that a proposition is either true or false.

In terms of propositional knowledge among TEI faculty members, items relative to the teacher's solid grasp of the subject matter content inherent in the lesson and the lesson having promoted strongly coherent conceptual understanding obtained the highest mean ratings of 4.40 and 4.38, respectively, which is interpreted as very descriptive. As for the procedural knowledge, the high mean ratings were given to the items on valuing of constructive criticism and challenging ideas and students being reflective about their learning.

Pedagogical knowledge

These cognitive activities are associated with the type of questions asked during the class. To elicit responses from the students, the faculty shifted from low level question to high level question or vice versa. This attested to research result that teacher questioning increased learning involvement as teachers ask questions not only to assess student understanding, but also to increase learner motivation and to guide the students in their new learning experience (Kauchak & Eggen, 1998).

The types of questions asked or activities utilized during the first 45 minutes are on the knowledge and comprehension level. It is during the last 45 minutes of the lesson that the observed faculty member asked critical thinking questions. The teachers' questions triggered divergent answers. Thus, there was a high proportion of student talk or activity.

Assessment Scheme

The enumerated assessment schemes were elicited from the results of the Classroom Observation Protocol that was conducted. As was evidently observed, the following strategies and techniques were utilized to assess learning: laboratory report, examinations, course projects, homework, practical tests, exhibits, oral reports, investigative projects, seatwork, pencil-paper tests, rubrics, portfolios, oral examinations, and oral defense of investigative projects.

Extent of Attainment of the Planned Curriculum

Concept tests were administered to sixty eight pre service teachers (PTs) enrolled in the TEIs included in this study. Of this sample population, 57percent are Biology majors, 39 percent are Chemistry majors and the remaining 2% majored in Physics. Their performance on the concept tests namely Biology Concept Inventory (BCI), Chemistry Concept Inventory (CCI), and Force

Concept Inventory (FCI) was used to describe their conceptual understanding of the basic science concepts.

Biology

Answers to the BCI revealed a mean score of 13.52 (SD=2.85). The theme of the BCI centers on three inter-related conceptual clusters namely randomness, process and structure, which define the common properties of biological systems. More than 50% of the PTs were able to answer correctly eleven out of the thirty items (36%). These include item nos. 1, 2, 3, 4, 8, 9, 11, 14, 17, 19, 20, and 23.These items pertain to the concept of scientific processes involved in evolution, energy flow, and transfer of genetic traits. Thus, present findings suggest that the PTs in the BSE Biology program have a clear understanding of the processes in biological systems such as energy transfer in plants and animals, evolutionary logic, and the transfer of genetic traits from the parent to the offspring. However, the BCI results also show that the PTs have alternative conceptions as most of them failed to answer correctly 19 out 30 (63%) of the items in the BCI. The percentage of pre service teachers who answered correctly item nos. 7, 18 and 30 were found to be low at 6.52%, 8.7% and 15.22%, respectively. These items pertain to the concept of randomness. Their failure to answer these items seems reflective of their lack of understanding that evolutionary and molecular processes are influenced by random events such as diffusion, genetic drift, and mutation. It is to be noted that understanding how random events are controlled to produce highly structured behaviors is a key to a nuanced view of biological systems.

Chemistry

The pre service teachers scored very low in the CCI. More than 50% of the PTs were able to answer correctly nine out of the twenty two items (40%). These include item nos. 1, 4, 7, 8, 9, 11, 12, 13 and 19 (Fig.). These items pertain to the concept of conservation of mass, energetics of forming and breaking bonds, phase changes, density, properties of water, and dilution. However, the CCI results also show that the PTs have alternative conceptions as most of them failed to answer correctly 13 out 22 (60%) of the items in the CCI. In particular, the percentage of PTs who answered correctly item nos. 5 and 14 were found to be low. Item no. 5 pertains to concepts related to conservation of atoms and the additive view of chemical reactions. A meager 7.4% of the students had good understanding of these concepts. This could be partly due to the students' inability to interpret particulate drawings that account for the amounts of limiting reagents as predicted and the initial amounts of reactants. Similarly, many of the PTs (approx. 93%) had trouble with item no. 14, which deals with the size of the atoms. The most popular response was D, with 60% of the students choosing this option. This could be attributed to the fact that the no. 6.02

X 10 23 is well known to the students as the number of atoms in a molecule.

Since the CCI items cover the foundation topics in Chemistry such as the particulate nature of the atom, results clearly indicate that the students' alternative conceptions are quite erroneous.

Physics

The performance of the students on the Force Concept Inventory (FCI) showed that they were able to answer 26% of the items correctly. These items pertain to the following concepts: constant acceleration (item no. 2), vector addition of velocities (item no. 7), gravitation as applied in parabolic trajectory (item no. 16), air resistance as applied in fluid contact (item no. 22), Newton's second law (item no. 24), Newton's first law relative to the superposition principle (28) and friction (item no. 29).

The data reveal the students' lack of analytical skills. Hence, they were not able to answer most of the questions. It must be emphasized that most of the concept test items require higher order thinking skills such as analysis, application, synthesis and even evaluation. During the interviews, the PTs admitted that they consider the study of Science courses relatively difficult because it requires them to have an analytical and inquiring mind to understand clearly the concepts. They also explained that most of the concept items were discussed in class; however, they have difficulty recalling the concepts. According to them, the lack of opportunity to apply the concepts learned could be a plausible explanation for their inability to correctly answer the test items.

Science Process Skills Test

The SPST has a maximum score of 94 clustered into ten process skills. Each skill was assigned a corresponding number of points. The PTs answered more than half of the items correctly on process skills D (inferring hypothesis), F (measuring and observing) and J (interpreting and analyzing). The rest were below 50 percent. The PTs obtained lowest scores on skills G, (making possible conclusions from an observation, and skill I (making predictions to test the hypothesis).

Pre service Teachers' Attitudes towards Science Teaching

The pre service teachers' level of attitudes towards science teaching is high as shown by the weighted averages ranging from 3.62 to 4.82. Of the three components, student teachers seemed to be cognitively and behaviorally better than affectively. The data suggest that students could have fared even higher in the biology and chemistry tests if they had higher affective development level. However, the students claimed that they are affectively lower; hence, they lacked vitality, dynamism or enthusiasm in using their cognitive skills which are manifested in their behaviors.

Pre service Attitudes Towards Science Learning

Students' success in school may depend largely on their attitudes towards science learning.

It means that there is higher learning success when students have higher view of science learning.

The data reveal that 65.38 percent hold high transitional views towards the learning of science. There were 19.23 percent who have expert views, 11.54 percent have low transitional view while

3.85 percent have a folk view. The mean of 17.24 indicates that students have high transitional view, which shows the presence of good attitudes towards science learning. Since the students possess positive attitudes towards science and science learning, these would make them persistent and would result in a higher performance.

Conclusion

Analysis of the gathered data revealed that there are some practices that are capable of equipping the pre service teachers with the concepts and skills they need to become good teachers. Teaching Practices Which Influenced the Pre-Service Teachers' Knowledge, Skills, and Attitudes The following data on the planned, implemented and attained curriculum are hereby presented to be able to benchmark effective practices that are capable of equipping the pre service teachers with the knowledge, skills and attitudes they need to become good teachers.

The data show that there are glaring differences as regards the variables in the planned, implemented, and attained curriculum. The total number of units for the course is higher in TEIs 2 and 4 compared with the minimum number of units offered by TEIs 1 and 3. The preparation of syllabi in TEIs 2 and 4 is done through adequate interfacing of experts unlike the preparation of syllabi in the other two TEIs which is prepared by the faculty who teaches the subject. The teaching strategies/activities, and assessment scheme gleaned from the course syllabi are almost the same. The faculty qualifications and length of experience are almost similar. A wide difference in the implementation of the Faculty Development Program as well as the opportunities for professional growth extended to the faculty was also discovered. There is also very big discrepancy in the capabilities of students in the four institutions. While TEI 2 and TEI 4 strictly screen their incoming students, the other two accept all types of students.

As regards the implementation of the planned curriculum, the data reveal that the faculty in the four TEIs involved in the study manifested almost the same pedagogical knowledge. They utilize almost the same assessment scheme in their classes.

On the attainment of the implemented and planned curriculum, the results of the BCI, CCI, FCI, and the SPST show a big difference. The performance of the pre service teachers of TEI 1 and TEI did not reach the desired level of at least 50% mark in all the standardized tests given them which imply that the practices of TEIs 1 and 3 were not effective in equipping the pre service teachers the knowledge, skills and attitudes that they need to become effective teachers. On the contrary, the performance of the PTs from TEI 2 and TEI 4 were all above the 50% mark. However, the pre service teachers' attitudes towards science teaching and learning in all the four TEIs are high.

It appears that enriched curricula and syllabi, a well implemented faculty development program, and strict admission and retention policies are practices that can bring about the attainment of the implemented curriculum.

The data suggest that educational qualifications, length of service, high attitudes towards science and science teaching even efficiency in teaching do not necessarily lead to the attainment of TEIs goals and objectives. Other factors like provisions for the professional growth of teachers, school culture, capabilities of the students are very imperative to the success of an institution.

Recommendations

It is imperative that the practices which resulted in the attainment of the planned and implemented curriculum be translated into policies and be disseminated to all TEI's in the country. Higher education institutions especially TEI's should invest time, money and effort to develop policies, programs, and the culture that will equip their faculty members with best practices for teaching-learning.

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