Practices of Pre-service Science Teacher Education Program: Review and Reflection

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Abstract

This paper aims to examine the effectiveness of the pre-service teacher practicum program of M. Ed level from the perspective of the campus supervisor of Gorkha Campus, Gorkha. There were altogether six students who appeared in the practicum program, and the researcher was their internal mentor for them. The teaching practice (practicum) program was conducted for about two months in six phases (four on-campus and two in cooperative schools). Based on peer observation and researcher observation analysis for each student-teacher classroom, five findings were identified and interpreted as Technological Pedagogical and Content Knowledge (TPACK) and related other theories. The analysis indicated that the theoretical, pedagogical knowledge was not much implemented in teaching. Their teaching was more traditional without ICT except for on-campus teaching practice. The obtained pedagogical and content knowledge was not tried to link their teaching with life-world knowledge, except a few student teachers did so. The pedagogical skills mentioned in the peer observation form were not developed fully even after the completion of the theory classes and the end of teaching practice. The critical scientific thinking (SCT) model is new and may be appropriate for the practicum program. This teaching practicum program was insufficient to fill the theory-practice gap using this model.

Keywords: competencies, constructive, pre-service, mentor, practicum

Context of the Study

Tribhuvan University, Faculty of Education, is one of the institutes which produces professional and academic teachers required for school and University levels in Nepal. In education faculty, to prepare qualified and trained teachers, each college involves the students in a practice teaching program. To prepare the academically qualified and pedagogically skilful teachers, the faculty of education conduct teaching practice at in Bachelor's and Master's level for one month to one and a half months at school or college. Mohan (2013) defined practice teaching as " a course or program in which the students or trainees are posted to schools, lower than their institutions of learning, to teach the student subject areas of their specialization for a specified period" (p. 58). The practice teaching purpose of bridging the gap between theory and practice in pre-service teacher education (Alle, Ambrosetti & Turner, 2013, p. 2009, Mohan, 2013, p. 59). Rusmansyah, Yuanita, Ibrahim, Isnawati, and Prahani (2019) focus on both problems based learning model and the inquiry model for improving critical thinking skills and self-efficiency of pre-service teachers. However, Rusmansyah et al. (2019) developed a new scientific critical thinking (SCT) model for more effective secondary level science teaching for pre-service teachers,

which is seen as appropriate to science teaching in our context and to narrow down the gap between the theory and practice in a critical way.
Moreover, Allen and Peach (2007) add that despite some problems, the practicum experience enables many students to develop a wider understanding of the profession and the importance of life-long learning (p. 8). Evren, Bati and Yilmaz (2012) added that to develop the critical thinking capacity of the students, "only content knowledge is not sufficient, and teachers should develop the required teaching skills to explore their learning experience" (p. 2268). He further states that the learning environment fosters students' thinking skills and constructs a positive attitude toward deeper thinking (ibid). Moreover, the teacher has the role of the facilitator and evaluates the process and product of the students (Sauastra & Ristiati, 2019, p. 3).

Legal Provision of Tribhuvan University Related to Teaching Practice (Practicum)
Tribhuvan University's faculty of education has been running a practice teaching program for the development of teaching skills of students in their constituent and affiliated campuses at the Bachelor's and Master's levels. At the B.Ed level, the education faculty runs the practicum program after the fourth year and has passed the method of teaching in the third year. Similarly, at the Master's level, the student admitted to the campuses and participated in the exam without passing any subject can participate in the practicum program conducted by the campus in the second year. But it is found that these programs held a single practice teaching session at the end of the instructional course work or included practice teaching throughout the instructional program (Ware, 1992, p. 18). Tribhuvan University has declared its curriculum of 1999 B.S that the person who passed the major subjects of the first year could only participate in the regular practicum program, but it was not implemented. At the B.Ed level, the Practicum program runs in two phases: Micro-teaching practice on related campuses (on-campus program) and teaching practice in related campuses and schools (Macro-teaching practice program). The microteaching practice program runs the related campuses for about 15 days (i. e.15 hours). But at the M.Ed level, this program runs for one week (i.e.7 hours).

Microteaching is a short form or scale down teaching in terms of time, students, and content (Ahmad, 2009, p.170; Mohan 2011, p.32). Microteaching aids, most importantly, remove the potential weaknesses of student-teachers (Sood, 1989). The purpose of micro-teaching is to enable the students to make a lesson plan with materials and to develop the skill of presenting (Mohan, 2013) the lesson. Likewise, it also aims to enable the students to prepare to SEE model questions, long answer questions, short answer questions, and objective questions such as multiples choice, fill the blanks, matching and multiple-choice questions. They develop the knowledge and skills of preparing school reports and case studies. Additionally, science students need to develop the knowledge of analysis of multiple-choice questions and prepare the report for the whole teaching practice program at the Master's (FOE, T.U, 2072 B.S.). Students should prepare the lesson plan with a constructive approach and practice in the classroom in front of their colleagues until they obtain the skills.

The phase program is an on-campus program where student teachers go to the related college/Schools/Campuses. According to Allen et al. (2007), the practicums are seen as gateways situated throughout the program to meet the standards against which students must demonstrate competence to proceed in the program (p. 26). B. Ed level students

involve 45 days, and Master level students are involved 30 days on related Schools/ Campuses, but it is recommended in Australia about 111 days practicum program (Allen et al., 2007, p. 25). At that time student-teacher prepares at least 30 lesson plan, prepare teaching materials and conduct effective classroom teaching-learning activities to develop the required skills and attitude (Mohan, 2013). In this phase, the student teachers should prepare at least 30 objective questions, two set matching questions, 10 fill-in-the-blanks, 10 true-false questions, and one set SEE model question /higher-level question set. Each student should fill the at least three peer observation forms of other student teachers and should provide feedback on their teaching competencies in the presence of their supervisors (FOE, T.U, 2072 B. S.). The student teachers should construct multiple-choice questions, administer them in the related class, and analyze and interpret the test results. Student teachers are expected to develop question selection skills. And this program attempts to provide a pedagogic scaffold (Dunne & Peacock, 2012) that prepares future teachers with the foundational knowledge and the requisite skills, techniques, and pedagogical strategies necessary to be able to teach effectively upon graduation and post-graduation. The program relies heavily on partnership arrangements with employers and schools and the shared understanding that teacher education is no longer a university problem but a joint schooling and university responsibility (Smith, 2000 as cited in Allen et al.,2007, p. 25)

M.Ed. level science education of T.U. had recently conducted four days orientation program on the New model of Practice Teaching. The newly approved model is mainly based on project-based and practical knowledge-based approaches (Sauastra & Ristiati, 2019). In the orientation program, students were oriented about the whole program they should complete in the teaching practice program. In this context, this article aims to enable student teachers to develop the knowledge and skills necessary for classroom teaching and acquire the knowledge for competencies and the overall report writing skills development.

Model of Teacher's Knowledge

Technological pedagogical and content knowledge mode was developed by Koehler, Mishra Coin (2013). He developed a conceptual framework which is shown in diagrammatical form is given below :

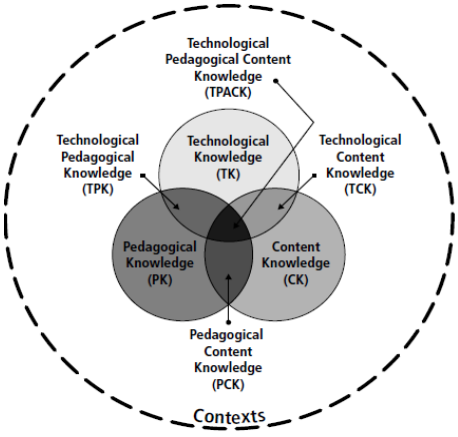

Fig.1. Technological Pedagogical and Content Knowledge (TPACK) Model (Koehler,

Mishra & Coin, 2013)
In the figure, some technological, pedagogical and content knowledge (TPACK) overlapped in the center of the circle, giving interlinked knowledge to each other. TPACK framework can be used to design pedagogical strategies and an analytic lens to study changes in educators' knowledge about successful teaching with technology (Koehler & Mishra, 2006). Before the development of TPACK, it was developed by Shulman (1986) in pedagogical content knowledge, but Koehler, Mishra and Coin (2013) developed it as a form of TPACK. This type of theoretical model is applicable in practice teaching to strengthen in-depth knowledge about content, pedagogy, and technology in pre-service teachers through TPACK (Koirala, 2019). In the present scenario, a competent teacher cannot get success in his professional and academic achievement without technological knowledge. So above prescribed model is seen as appropriate for the holistic development of teachers in this study.

Methodology of Practicum Program

This section is about the plan for the study. It explains the procedures for analyzing and interpreting the cases determined by the purposes of the study. This study uses the qualitative research design. This research is carried out first purposively selecting (Best & Khan, 2000, Creswell, 2007) Gorkha Campus, Gorkha, where I have been teaching science for 11 years and worked as a mentor of science education in all the practicum programs this campus. This study is based on the M.Ed Fourth-semester students' practicum program held in 2018. Second, this was on campus as well school teaching practice program in selected secondary schools. The selected secondary school that I supervised were Shakti Secondary School and Mahalaxmi Secondary school.

A four-day on-campus orientation program was conducted in the first phase on June 18-21, 2018. In the orientation program, the student teachers were familiar with the different phases of teaching practice and the program's requirements. Then the second and third phase of teaching practice was conducted. In these phases, students were oriented to observe at least three classes of related science teachers and note down the good practices. For example, they can follow important techniques in their teaching practice program later. From the class observation, they learned subject matter knowledge, planning and classroom management, delivery of content, ways of addressing the problems, effective use of materials in the classroom to clarify the concept. After observing the three classes in the first week, they prepared a brief report of observation of teaching. They presented the report for experiences sharing with friends in the presence of their facilitators.

In the fourth phase, one week On-Campus Micro Teaching Program was conducted. In this phase, students were oriented to prepare the micro and macro lesson plan concentrating on constructive teaching methods. They prepared teaching aids related to teaching the topics and presented the lesson before the student teachers. They used slides for the presentation of the lesson, which helped them to make their class as far as constructive mode. They used different types of teaching materials like charts and models to make their classroom teaching effective and interesting. They prepared five lesson plans as instructed by the instructor and presented the lesson in front of their pairs turn by turn until they obtained the instructional goals. At least they presented three classes to enhance their performance. They filled out the classroom observation form in which the detailed

information was given. The guideline was mainly based on the development of learning objectives, selection and use of instructional materials, educational climate for learning, variety of instructional activities, preparation for a class session, instructional methods, opportunities for student participation, individualization of instruction, responsiveness to students' feedback and learning difficulties. The peer observation form provided all types of knowledge. It informed all students to fill out the peer observation forms to understand how they develop the competency in both pedagogy and content matter and how their technological knowledge was to deliver and search the new knowledge.

In the fifth phase program, the students were sent to two cooperative secondary schools as; Shakti Secondary School and Mahalaxmi Secondary School, for Six weeks practicum program. They were asked to make 30 lesson plans and to fill in at least three peer observation forms in the presence of the campus supervisor. They were asked to prepare and conduct the subjective and objective test items and analyze and interpret test results. As suggested by Ahmad (2009) all the students involved in the constructive teaching-learning program prepared the lesson plan using the constructive method and prepared different types of teaching materials like charts and models related to the subject matter. They prepared subjective and different types of objective questions and analyzed the objective questions' difficulty level, discrimination index and effectiveness of distracters. They had developed the knowledge of the selection of appropriate questions for further use.

In the final phase of the program, the students were instructed to prepare the overall report of the teaching practice in a given format. They were instructed to analyze all the peer observation forms which they observed in the classroom, analysis and interpretation of test items, preparation of school reports, competencies learned in teaching-learning activities. All student teachers filled three observation forms of a different colleague in the presence of a mentor (Field Observation Note). The teaching skills were analyzed in thematic form compared with TPACK and other effective science teaching models and theories.

Results and Findings

After six-week teaching practices in selected secondary schools, their final class was observed in the presence of an external supervisor. I had supervised the class of students teachers who were teaching in both schools. Six participant student teachers prepared all the documents for the final class observation. They prepared an overall report of teaching practice. Their overall documents were observed turn by turn by external and internal supervisors. The external supervisor was also happy after seeing all the documents because all the documents were according to the new instruction delivered by the Dean's office. The classroom activities of all students were creative, and they presented their class in a constructive way which was new practices. After then, I collected all the documents from the students and evaluated them one by one in the presence of an external supervisor. I collected all the peer observation forms separately to analyze the teaching skills measurement capacity of the students. Fourteen basic skills should fill all the pre-service student teachers in the short descriptive form. The teaching skills and their description are presented below in the table.

Table 1:
Skills developed by observers from class observation

S.N	Basic skills	First student	Second student	Third student	Fourth student	Fifth student	Sixth student
1	Classroom management	nicely managed	good management	well management	good management	properly managed	perfectly managed
2	Learning environment	participative and interactive	effective	participative	participative	Democratic	democratic and well manage
3	Clarity	clearly presented	clearly presented subject matter	clear	clear	clear	clear
4	Enthusiasms/ personal qualities	found to be enthusiastic	found to be enthusiastic	found to be enthusiastic	found to be enthusiastic	found to be enthusiastic	found to be enthusiastic
5	Content knowledge	good content knowledge	good content knowledge	good content knowledge	good content knowledge	good content knowledge	good content knowledge
6	Presentation skills	clearly/ appropriately presented	good	appropriate/ clear	clearly presented	clear	systematic/good
7	Speaking/ language	so clear	so clear	clear	clear	so clear	so clear
8	Rapport with students	developed rapport with students	developed rapport with students	developed rapport with students	developed rapport with students	developed rapport with students	developed rapport with students
9	Use of instructional materials	chart/was good	chart	chart	chart	chart	materials used
10	Instructional strategies	strategies were good	demonstration / collaboration/ co-operative	strategies were good	strategies were good	demonstrating and discussing	demonstrating and discussing / question answer
11	Time management	good management	well	good/ properly managed	good/ perfectly/ well	well	good
12	Use of new technology /ICT	not used any technology	not used any technology	not used any technology	not used any technology	not used any technology	not used any technology
13	Gesture	moved hands	moved hands	moved hands	moved hands	used gesture	used gesture
14	Concluding	summarized the whole lesson	summarized at last	summarized at last	summarized at last	well	good

From the classroom and peer sheet observation, the following findings were concluded.

1. Classroom management and student involvement
2. Teaching/presentation skills
3. Use of instructional materials
4. Use of ICT
5. Skill developments

Each of the findings is elaborated below with a discussion of relevant theories and models of science teaching

Discussions

The discussions have been subsumed in the following sub topics:

Classroom Management and Student Involvement

The classroom management system which I observed in different classes is found satisfactory. The classroom was full spacious. The number of students was less than 20 in a science classroom in both high schools. So that student teachers did not have any problem managing the classroom. Students occupied their seats properly. However, there was a problem with students' involvement in classroom activities. As stated by the critical scientific thinking (SCT) model, students' involvement should be high, but teachers were found somehow active in classroom teaching, trying to involve the students in learning activities, but students were not being so active and creative in their classroom observation. In my view, "keep silent" is not the purpose of effective science teaching.

Teaching/Presentation Skills

I observed all together 30 classes, from microteaching to final, as a facilitator of Gorkha Campus. Their teaching/presentation was gradually increasing way. They fully involved the students in teaching-learning activities. They constructively involved the students in teaching-learning activities. Both internal and external supervisors were satisfied with their class presentation in the final class. But, as Koehler et al. (2013) mentioned in their model, the technological and content knowledge was not found strong in all student teachers. Technology use is seen as problematic by almost all teachers. However, the pedagogical aspect of delivering knowledge was appreciable by almost all teachers, both in-classroom observation and analyzing and interpreting peer observation form. The TPACK model should be fully implemented for effective science teaching in this 21 st century's technological era to scaffold student teachers' knowledge (Dunne & Peacock, 2021).

Use of Instructional Materials

The nature of biology teaching is field-oriented and mostly based on showing chart paper and real objects. The chapters which I observed was used chart paper as teaching material. Student teachers prepared an appropriate chart paper size and presented it to fulfil the objectives mentioned in the lesson plan. It was not found to use the other teaching materials as teaching materials. There was a lack of local materials and technology as teaching tools. Technological involvement in practice teaching should be a minimum requirement in the 21st century's knowledge and skill achievement. According to Dunne and Peacock (2012), the use of appropriate teaching material with technology embedded supports the achievement of pedagogical content knowledge (PAK) that enhances creative learning, constructive learning, and better understanding of subject matter. So the use of different types of materials is seen as essential for teaching science. However such different types of material were not found used in science teaching by the student teachers.

Use of Information and Communication Technology

These days are the time of science and technology. People are affected by the innovative technology, but our classroom teaching-learning activities are moved in traditional ways.

Both high schools have well-managed ICT lab facilities and internet servers, but no one uses them. I know that they have the ICT knowledge and used them at the time of the on-campus program. But, they are either guided by traditional teaching methods or neglect ICT facilities; both class observation and peer form analysis are seen lacking ICT use. As said by Koehler et al. (2013), technology plays a crucial role in enhancing students' achievement, but students teachers show their reluctance for its effective use in classroom teaching. If effectively used the ICT tools for science teaching it would enhance the competencies of student teachers (Ahmad, 2009) for further classroom teaching but the classroom observation scenario of those student teachers I can not find developed such competencies for other use.

Skill Development

The main theme of the teaching practice program is to develop the basic skills of planning and implementing new teaching ideas. Student teachers have developed the skills of planning lessons according to the objectives. They have developed the knowledge of preparing different questions, analyzing and selecting appropriate questions, and preparing a report of the whole program. They have developed somehow the skills of preparation and use of teaching materials. However, there was a lack of critical scientific thinking towards both student teachers and students for the holistic development of students (Rusmansyah et al., 2019). So, student teachers were not found implementing their creative and critical thinking knowledge and skills through the involvement of students. Whenever students teachers get sufficient knowledge about the scientific critical thinking skills that are developed (Rusmansyah et al., 2019), it would automatically support the betterment of science teaching in our context.

Conclusion

As a supervisor of the M.Ed level science practicum program, I observed that the practicum program conducted by the Faculty of Education, Dean's office, Tribhuvan University, was according to the time frame and accepted the given instruction. Still, it was not actually seen in the practice. This study focuses only on implementing the program of M. Ed level. Teaching Practice of science students of Gorkha Campus, Gorkha, mainly based on analysis of the teaching practice program and the peer observation form filled by the students in the presence of a mentor in different teaching situations and phases.

But there is still no use to see the relationship between how the mentor and school supervisor helps for effective teaching in different observations and how the mentor helps to decrease the gap between theory and practice by using an effective teaching model to enhance student teachers' teaching knowledge and skills. It is seen better to do this type of study at the bachelor's level and in other institutions. From the study model and my own teaching experience, it is seen that the issue of the theory-practice gap is neither minor nor benign. This study supports several other studies for more empirical evidence to demonstrate the link between student teachers' learning and their practices in the classroom and for ways of better preparing and supporting students for and during the practicum experience.

Dean's Office, Faculty of Education, is implementing a new teaching paradigm at the M.Ed level (FOE, 2072 B.S.). Gorkha Campus, Gorkha is implementing it in the classroom practice. The analysis of observation revealed that either the students have not achieved

the required pedagogical skills or the pedagogical skills mentioned in the form are unclear. It is a necessity to reform the peer observation form. During the practicum period, the mentor, school and campus supervisors should monitor the class regularly and provide constructive suggestions. Similarly, the student teachers should be motivated to implement a new teaching model for effective students participation in classroom teaching.

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