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Promoting the Development of Teacher Professional Knowledge: Integrating Content, Pedagogy and Technology while Teaching

Abstract

With the changing role of the teacher from a transmitter to a facilitator and advancement of technology in educational discourse, technological knowledge has become an integral part of teacher education programmes. Technology was introduced as an aid to teachers to support their instruction so that teachers can satisfy the diverse learning needs of today's inclusive classrooms. But acquisition of technological knowledge exclusively as a separate domain during pre-service or inservice teacher education fails to develop understanding of the applications of technology in integration with other basic knowledge domains of teachers' i.e. content knowledge and pedagogy knowledge. The current paper discusses knowledge structures of teachers and their integration to make science learning more meaningful and interesting. This paper presents the findings of a need based training programme conducted to study knowledge structure of teachers and its integration in the teaching-learning process. 27 in-service secondary school science teachers from 14 states of India participated in the study. Based on the identified needs, knowledge structures were strengthened providing scope for discussions, reflections along with hands on activities during the training. Pre-tests and post-tests were administered to find their knowledge base and confidence levels before and after training to see any improvement in their knowledge structures on integration of content, pedagogy and technology while teaching. Analysis reveals that there is a significant improvement in content knowledge, pedagogical knowledge, technological knowledge and integration of all these among the teachers. Further it was also found that there is a shift in the confidence level from moderately confident to extremely confident and reduction in number of individuals who are not confident when compared before and after training in the content, pedagogical, technological knowledge and their integration.

Introduction

Development of educational system is one of the most important concerns among stakeholders of education all over the world. Strength and effectiveness of any educational system is directly proportional to effectiveness and preparedness of its teachers. Teachers are the main driving force of an education system. They play a pivotal role in the process of teaching and learning. The question that arises here is, how and in which areas, one of the most important stakeholders of education (teachers) should be trained. One of the basic requirements is to keep them updated with recent developments in the field of teaching-learning, through professional trainings. Recent developments may include new developments in the content area or new teaching approach that has proved to be more effective through researches or any advancement made in technology which can be utilised to make teaching-learning more effective. Teachers if trained in these recent developments in segregation without establishing linkage of new knowledge with

their pre-existing knowledge and without building linkage of one form of knowledge with another will not lead to successful implementation of new knowledge in real classroom situations. Holistic/ integrated approach, where all knowledge structures of teachers are utilised in transaction of content can only satisfy the diverse classes of today's Inclusive era.

Merely imparting knowledge or providing instruction cannot be considered as teaching. According to Hirst (1975), teaching should involve consideration regarding people's feelings, experiences and needs. Understanding a student's feeling, knowing her/his cognitive level and then teaching everyone together in such a way that it satisfies every student's learning need scan only be possible, if the teacher integrates all his/her knowledge structures and approaches content in a holistic manner. Here a question arises what are the different knowledge structures of teachers and how they could be integrated for meaningful learning to take place.

Knowledge Structures in a Science Teacher

Researchers before 1982 majorly focussed on various general aspects of teaching, and rarely paid attention to role of content in teaching. Basically subject knowledge and teaching were considered to be two separate dimensions; and least attention was paid to understand how teachers understand the subject they teach. Since teacher education programmes treat teachers subject knowledge and pedagogical knowledge as separate domains, due to this exclusiveness, Shulman (1987) claimed that graduates were therefore ill-prepared for the cognitive complexities of teaching. In mid-1980, a new perspective has been brought to teacher's knowledge when Lee Shulman introduced an important domain of teacher knowledge that is "Pedagogical Content Knowledge" (or PCK). He emphasised integration of domain knowledge with appropriate pedagogy, so that meaningful learning can take place. Shulman considered knowledge base of teachers in content knowledge, pedagogical knowledge, curriculum knowledge, knowledge of learner and educational context and knowledge of educational outcomes, purposes and values (Evens, Elen & Depaepe, 2015). Later, many researchers echoed the same views and elaborated upon Shulman's initial framework. While Grossman studied PCK in context of language, Magnusson et. al., studied PCK in context of Science and developed a model in which they included 3 more components to Shulman's initial framework. These components were orientation to Science teaching, knowledge of Science curricula and assessment of Science literacy. Ball et al. studied PCK in context to Mathematics and developed a model which in addition to Shulman describes knowledge of Mathematical horizon (how separate mathematical concepts relate to each other) (Evens, Elen & Depaepe, 2015).

According to Koehler & Mishra (2005), teacher knowledge is extremely complex and multifaceted. It is considered to be dynamic, influenced by the social and cultural environment and usually situated in ill-defined contexts (Angeli & Valanides, 2009).

With the technology boom, educational technologies were deliberately made an integral part of 21st century classrooms and thus became an integral part of teacher education programmes. Despite technology inclusion in teaching-learning and emergence of technology knowledge as a critical attribute of 21st century teachers, there exists a limited understanding of the applications and conceptual grounding of theoretical frameworks in educational technology literature that aims to inform the pragmatics of teaching learning with technology (Phyfe & Vermette, 2012, Graham, 2011). Hechter & Vermette, 2012, also found it unfortunate that despite support, literature and community; in-service teachers still find it difficult to effectively integrate modern technology into their classrooms.

To meet this growing demand of technology in educational discourse and to improve teachers' effectiveness in integration

of ICT in teaching-learning, Mishra & Kohler, 2006, along with other researchers (Neiss, 20005, Angeli, 2005, Graham, 2011) emphasised extending Shulman's PCK with technology domain. Kohler and Mishra thus introduced a knowledge base for teachers to teach effectively by integrating technology with content and pedagogy. This knowledge base is known as Technological Pedagogical Content Knowledge (TPCK). TPCK comprises the integration of content, pedagogy and technology domain within educational contexts. It reveals how three knowledge domains intersect and can be integrated to facilitate and enhance teaching-learning in the classroom. According to Mishra & Kohler, 2006, TPCK framework presents a specific form of knowledge which has emerged from conjunction of the base components, these base components are at the core of the teaching profession, requiring an understanding of best pedagogical approaches and representations of concepts using suitable technology in relation to students' prior knowledge and learning difficulties.

Along with Kohler & Mishra, other researchers have also described the relationships between technology, pedagogy and content a few among them are Huges (2004); McCory (2004); and Niess (2005). Franklin, 2004 addressed this integrated knowledge as e-PCK, while Angeli & Valanides, 2005 gave ICT related PCK. All these frameworks basically focus on relationship between three domains of knowledge, i.e content, pedagogy and technology.

From literature review it is evident that in order to translate curricular expectations in general and learning outcomes in specific, every teacher utilises the content, pedagogy and technology knowledge structures along with the knowledge of their integration in their classroom processes. These knowledge structures find an important place in both pre-service and in-service teacher education programmes.

1. **Content Knowledge** includes knowledge of subject to be taught, understanding of nature of the subject, ability to identify different categories of content, understanding of organisation of content for its smooth transaction in class. It also involves knowledge of process skills to be developed among students, while teaching the subject, and development of right attitude and values that are essential for learning the subject.Content knowledge can be categorised into factual knowledge, conceptual knowledge, procedural knowledge and metacognitive knowledge. Different processes are involved in the formation of different content knowledge, like concepts can be formed by induction, wherein, the individuals observe specific objects or ideas, identify the common characteristic features, group and name the concepts. This involves the process of moving from specific examples to generalisations.
2. **Pedagogical Knowledge** includes knowledge of how to deal with the content, what will be the right approach to transact the content in the class, which strategy should be adopted so that learners are able to create knowledge of their own and are able to apply that knowledge in practical situations or to solve their problems. Pedagogical knowledge also includes application of different assessment strategies to assess learner's progress according to the objective of learning.
3. **Technological Knowledge** includes knowledge of resources both physical and digital, which could be utilised to make learning, interesting effective, meaningful and accessible for all. After implementation of PWD and RPWD Act, we could see learners with diverse abilities in present classrooms. To satisfy diverse cognitive and physical needs of students, and to make learning accessible for all, technology proves to be the best aid for teachers.

Technology supports teachers to create deep understanding of the subject, to make abstract concepts comprehensible, to visualise spatial arrangement of 3D structures and in arousing interest

among learners. Technology can be selected according to specific needs of learners, nature of content and strategy employed by the teacher.

During classroom situation, these knowledge structures as a separate entity do not prove to be sufficient as nature of content influences teaching method, like a fact cannot be proved by laboratory activity but generalisation can be. Similarly lecture method will not be effective enough to test presence of starch in potato. Likewise technology will not prove to be effectively used without considering nature of content and pedagogy being used. While teaching, these three basic knowledge domains interact and intersect, giving rise to four more knowledge structures of teachers which are as follows.

4. **Pedagogical Content Knowledge (PCK)** refers to content knowledge that deals with the teaching process (Shulman, 1986). It basically focuses on teaching a particular content, keeping in mind the learners' cognition level, abilities, learning difficulties and educational context. In diverse classrooms of the present era, teacher's have to satisfy students with different learning styles. In such situations, teachers knowledge about different pedagogical strategies and how to integrate this knowledge with their subject knowledge becomes essential for providing meaningful learning experience to 'All' students. Lecture and demonstration may not achieve all learning outcomes and satisfy every student's learning needs. There may be some kinesthetic learners for whom role play could serve the purpose, there may be some for whom hands on activities may be required for learning to take place. Understanding a learner's need, abilities and cognition level makes one of the most important aspects of pedagogical content knowledge.

Later Kohler & Mishra (2006) added three more knowledge structures giving emphasis to technological knowledge in a different perspective which include:-

5. **Technological Content Knowledge (TCK)** involves understanding of selection of appropriate technology that is best suited for the content to be transacted in class.
6. **Technology Pedagogical Knowledge (TPK)** involves understanding of selection of most suitable technology keeping in mind the constraints of pedagogy being used.

Then they explained how TPK, TCK and PCK also intersect with each other and give rise to a separate knowledge domain called **Technological Pedagogical Content Knowledge**. Keeping in mind the importance of these knowledge structures in teaching-learning, a training programme was conducted by the researcher to enhance teachers' knowledge structures required for integration of technology in teaching-learning.

The paper is built from the researchers' observations and findings of the conducted training programme.

Objectives of the Study

1. To study the difference in confidence levels of secondary school in-service Science teachers in integration of content, pedagogy and technology.
2. To study the difference in perception of teachers on integration of content, pedagogy and technology.
3. To study the difference in the knowledge structures of secondary school in-service Science teachers before and after the training.

Methodology

Design

This study was carried out to understand the knowledge structures of Science teachers and to strengthen them to integrate content, pedagogy and technology while teaching through a training programme. Training began with administration of pre-tests (test

on knowledge base and a confidence scale), followed by capacity building activities. Sessions were focussed on building conceptual clarity, skill development through hands on activities, concept mapping, demonstrations, group discussions, presentations and practical sessions. Part to whole method was tried out in a systematic way wherein the teachers were reminded of the structure of Science, Scientific methods, Science processes, Science related values as a first step. Then they were helped to recall various methods, their merits and demerits through various activities. Hands on experiences with various softwares/ technologies especially deliberations on why, when and how of using them in the classroom teaching were discussed. Focus was on equipping and strengthening the content knowledge, pedagogical knowledge and technological knowledge and then through various activities opportunities were created wherein the teachers tried to integrate them in developing lesson plans. The lesson plans were discussed, analysed, modified and implemented in a simulated situation during the training programme. Constructive feedback was provided by the resource persons and co-participants.

Scores of pre-test and post-test are compared to see the difference in knowledge base of teachers. Frequencies and percentages were calculated for the responses of the participants on confidence scale.

Contents of the Training Programme

1. Content Knowledge – nature, types, construction
2. Pedagogical Knowledge – methods, approaches, strategies
3. Technological Knowledge – nature, scope and importance, ICT tools in planning, implementation and assessment
4. Pedagogical Content Knowledge - alternate conceptions, assessment, etc.
5. Integration of technological knowledge with the other knowledge structures

Sample for the Study

A five day capacity building programme focusing on integration of content, pedagogy, assessment and technology was carried out wherein 27 in-service Science teachers from 14 different states of India participated.

Tools Developed and Used

1. **Need Assessment Format:** Need assessment has been carried out through a questionnaire, to identify the training needs of the Science teachers with respect to content, pedagogy, technology, assessment and their integration. It consists of 15 statements and participants responses were collected on two criteria, namely- "I am comfortable at" and "I hope to learn".
2. **Pre-test and Post-test for testing the Knowledge Structures:** Parallel forms of tests were developed with 26 situational testing questions testing content knowledge, pedagogical knowledge, technological knowledge and questions to test teachers ability to integrate these three domains including assessment while teaching. Each correct answer was assigned 1 mark. Total score was given out of 26.
3. **Confidence Scale**: It is a rating scale ranging from 'extremely confident' to 'not at all confident'. It encompasses 32 statements to see participant's entry and exit level confidence in above-mentioned knowledge structures.
4. **Reflection Forms:** It consists of 7 closed-ended questions on duration, reading material, interactivity, presentation and resourcefulness of training programmes. Reflection form also includes open-ended questions on knowledge or skills acquired during the session, positives and negatives of the session and scope of improvement in the area. Overall, perception of the teachers on the training programme were collected through these forms.

Analysis and Interpretation of Data

To study the confidence of secondary school in-service Science teachers in integration of content, pedagogy and technology before and after intervention, the frequencies and percentages of responses of teachers on confidence scale were calculated as given in Table 1:

Table 1: Frequencies of Responses on Confidence Scale Before and After the Training Programme:

S.No.	Statement	Before training			After training		
		EC* f(%)	MC* f(%)	NC* f(%)	EC* f(%)	MC* f(%)	NC* f(%)
Content Knowledge							
1.	Using various ways of constructing scientific knowledge among students	2(7.4%)	18(66.7%)	5(18.5%)	14(51.9%)	10(37.0%)	1(3.7%)
2.	Identifying various components of scientific knowledge	3(11.1%)	15(55.6%)	6(22.2%)	14(51.9%)	9(33.3%)	1(3.7%)
3.	Satisfying queries of my students on Science	3(11.1%)	18(66.7%)	4(14.8%)	15(55.6%)	8(29.6%)	1(3.7%)
Pedagogical knowledge							
4.	Using various methods of teaching Science	2(7.4%)	20(74.1%)	4(14.8%)	12(44.4%)	11(40.7%)	1(3.7%)
5.	Selecting methods based on their merits and demerits	3(11.1%)	18(66.7%)	5(18.5%)	15(55.6%)	8(29.6%)	1(3.7%)
6.	Adapting my teaching based on students current knowledge	7(25.9%)	15(55.6%)	4(14.8%)	16(59.3%)	6(22.2%)	2(7.4%)
7.	Managing efficiently the class in group activities.	7(25.9%)	17(63.0%)	2(7.4%)	15(55.6%)	5(18.5%)	3(11.1%)
8.	Motivating students through various pedagogical practices	6(22.2%)	18(66.7%)	2(7.4%)	14(51.9%)	7(25.9%)	3(11.1%)
9.	Engaging students with sustained involvement in the class	4(14.8%)	19(70.4%)	3(11.1%)	14(51.9%)	7(25.9%)	2(7.4%)
10.	Adapting my teaching style to the needs of diverse learners	5(18.5%)	14(51.9%)	7(25.9%)	11(40.7%)	10(37.0%)	2(7.4%)
Technological Knowledge							
11.	Using ICT tools in the teaching learning process	1(3.7%)	8(29.6%)	17(63.0%)	5(18.5%)	20(74.1%)	0(0.0%)
12.	Solving problems that arise while using technology in classroom	3(11.1%)	8(29.6%)	14(51.9%)	6(22.2%)	16(59.3%)	2(7.4%)
13.	Using ICT for assessing students' learning	2(7.4%)	10(37.0%)	14(51.9%)	8(29.6%)	13(48.1%)	3(11.1%)

14.	Using technology to report the students' progress to parents	0(0.0%)	9(33.3%)	17(63.0%)	7(25.9%)	14(51.9%)	3(11.1%)
15.	My rights and responsibilities in using digital resources and tools	3(11.1%)	12(44.4%)	11(40.7%)	10(37.0%)	14(51.9%)	0(0.0%)
16.	Using ICT to collaborate with colleagues	2(7.4%)	11(40.7%)	10(37.0%)	11(40.7%)	11(40.7%)	3(11.1%)
Integration of content, pedagogy and technology while teaching							
17.	Demonstrating understanding of safe, legal and ethical use of digital information and technologies	4(14.8%)	8(29.6%)	12(44.4%)	11(40.7%)	10(37.0%)	1(3.7%)
18.	Selecting appropriate approach or method or the content to be taught	1(3.7%)	13(48.1%)	13(48.1%)	7(25.9%)	15(55.6%)	1(3.7%)
19.	Treating facts, theories, concepts, laws with an appropriate method or strategy	1(3.7%)	13(48.1%)	13(48.1%)	9(33.3%)	13(48.1%)	1(3.7%)
20.	Designing the assessment formats based on the methods of teaching	2(7.4%)	11(40.7%)	13(48.1%)	7(25.9%)	15(55.6%)	0(0.0%)
21.	Re-organising the content and deciding the pedagogy accordingly	3(11.1%)	14(51.9%)	9(33.3%)	10(37.0%)	14(51.9%)	0(0.0%)
22.	Using different forms of assessment to check students' performance in a classroom	4(14.8%)	13(48.1%)	9(33.3%)	9(33.3%)	13(48.1%)	2(7.4%)
23.	Selecting technology that aids in constructing concepts, theories etc.	3(11.1%)	7(25.9%)	15(55.6%)	8(29.6%)	17(63.0%)	0(0.0%)
24.	Choosing technology to enhance the content for a lesson	1(3.7%)	12(44.4%)	12(44.4%)	10(37.0%)	15(55.6%)	0(0.0%)
25.	Selecting and using ICT tools to promote process skills among the students	2(7.4%)	10(37.0%)	13(48.1%)	8(29.6%)	17(63.0%)	0(0.0%)
26.	Using technologies that enhance my teaching approaches for a lesson	1(3.7%)	9(33.3%)	14(51.9%)	7(25.9%)	16(59.3%)	1(3.7%)
27.	Selecting and using ICT and teaching strategies to cater to diverse needs of learners	3(11.1%)	6(22.2%)	15(55.6%)	6(22.2%)	17(63.0%)	1(3.7%)
28.	Using ICT to assess, record and analyse student's data	0(0.0%)	8(29.6%)	16(59.3%)	6(22.2%)	16(59.3%)	2(7.4%)
29.	Designing activities to make learners active participants.	3(11.1%)	8(29.6%)	13(48.1%)	8(29.6%)	16(59.3%)	0(0.0%)
30.	Designing lesson plan and implement using ICT tools with the desired pedagogy	0(0.0%)	8(29.6%)	15(55.6%)	9(33.3%)	13(48.1%)	1(3.7%)

31.	Teaching lessons appropriately combining content, pedagogy and technology	0(0.0%)	13(48.1%)	12(44.4%)	12(44.4%)	11(40.7%)	2(7.4%)
32.	Managing the class when content, pedagogy and technology integrated lesson is implemented	0(0.0%)	5(18.5%)	20(74.1%)	8(29.6%)	16(59.3%)	1(3.7%)

*Note: EC: Extremely Confident
MC: Moderately Confident
NC: Not at all Confident

From the above table it is evident that there is increase in confidence level of teachers in integrating the content, pedagogy and technology while teaching. There is a shift in the confidence level from moderately confident to extremely confident and reduction in number of individuals who are not confident when compared before and after training in the content, pedagogical and technological knowledge. Among the three, the increase is more in technological knowledge of teachers after the training programme.

It is also observed that there is high number of teachers who were not confident in integrating content, pedagogy and technology while teaching before training, which came down to one to two persons on one side. Number of teachers who responded extremely confident increased after training on the other side. During the discussions, *many of the teachers informed that they were not aware of the softwares, free and open ICT tools that could be used to enhance the teaching learning process and also expressed that they took it for granted that it was too difficult to even learn them. Some who knew about some of the tools were not knowing* as to how to integrate them while teaching.

To study the difference in perception of teachers on integration of content, pedagogy and technology, a questionnaire was administered to all 27 participants online. It was evident from the responses of questionnaire that teachers were competent in their subject knowledge, they also had basic awareness about teaching processes. Teachers were found to possess lower level of awareness about educational tools available. Though some teachers were aware of a few digital tools, but none was found equipped enough in integration of three i.e. content, pedagogy and technology. Analysis also revealed that though the teachers had mastery over the content but they were not aware about the different categories of content and how each content category could be identified and how to select pedagogy keeping in mind the nature of content. Selection of teaching method according to content emerged as one of the challenging area. Similarly, lacuna was observed in teacher's knowledge related to selection of technology based on nature or category of content and teaching method used.

During training, reflection forms were given to participants after each session to collect their feedback on each session. Analysis of reflection forms and semi-structured interview with participants (held after training) reveals following changes in participant's perceptions towards content, pedagogy, technology and their integration in Science teaching-learning process:

- "I never analysed content before teaching. I understood why I was not able to select method to teach. Identifying various components of scientific knowledge and understanding the process of acquiring them, made selection of the method of teaching easy."
- "Importance of identifying misconceptions of students consciously was never a part of interventions. Now I understand that if I address those conceptions half the work is done. How to handle them also is now made clear in this training programme."
- "It was always difficult to manage the group activities within the class time. I

learnt planning and executing especially group activities within the time limit in these five days."

- "During the training programme using ICT in various activities gave me confidence and I am now comfortable to use it not only for improving teaching-learning but also for my professional growth and collaborating with colleagues."

Some teachers also expressed that they could understand safe, legal and ethical use of digital information and technologies. Now they are confident of using it the way it has to be.

- "Assessment for and of learning were known to us, but assessment as learning was new to us. We could understand that assessment surely helps us to understand ourselves better. We could design the assessment formats like rubrics, worksheets, portfolios based on the methods of teaching during the training programme."
- "Even though I know various free and open source, software, I was not sure of which one, when and how to use them to enhance the content and the method of teaching."
- "Employing ICT tools that are responsive to students learning styles is one of the point that I realised during this training programme. Consciously we were made to think of various activities through which process skills are promoted and ICT usage in the process."
- "How to make assessment an integral part of the lesson using ICT is a new thing which I learnt here. Added to this I also understood how ICT can make it convenient to record and analyse student's data."
- "Designing lesson plans with integration of content, teaching methods, assessment and technology gave a concrete experience due to which we are confident of using it in our future classes."
- "I realised when and where to use ICT. It is important to understand that if used judiciously ICT can really help us in substitution, augmentation, modification and also redefining the concepts."

To study the difference in the knowledge structures of secondary school in-service Science teachers before and after training, total score obtained on content knowledge, pedagogical knowledge, technological knowledge and integration of all these was calculated and a paired sample test was employed. The results of the test are tabulated below:

Table 2: Mean difference of knowledge structures of teachers before and after training

Knowledge structures		Mean	N	S.D.	T
Content Knowledge	Pre-test	3.39	31	1.667	*10.531
	Post-test	5.87	31	1.875	
Pedagogical knowledge	Pre-test	4.97	31	1.278	*9.613
	Post-test	6.94	31	1.769	
Technological knowledge	Pre-test	2.77	31	1.203	*8.563
	Post-test	4.90	31	1.446	
Integration of CK, PK, TK	Pre-test	1.61	31	0.919	*7.255
	Post-test	3.65	31	2.229	
Overall	Pre-test	12.77	31	3.008	*16.434
	Post-test	21.35	31	4.957	

* Significant at 0.05 level

From the above table it is evident that there is a significant improvement in content knowledge, pedagogical knowledge, technological knowledge and integration of all these among the teachers.

Discussion

Understanding of knowledge structures was not an easy task, nor developing the knowledge bases among teachers. It requires a comprehensive understanding of the core knowledge and interaction of the knowledge within the teaching context (Mishra & Koehler, 2006; Niess, 2005). Although pre-service teachers were confident about the complementary knowledge bases before field experience, their use of ICT during field experience was limited. It is all the more challenging with inservice teachers who had to unlearn and relearn certain aspects of teaching.

It was found that the inservice teachers were good in their subject matter, but were not understanding the structure of Science, and process of acquiring scientific knowledge. In turn they have a knowledge base of various methods/approaches of teaching, but again were not confident enough to decide when to use what. Technology is an area of interest to most of the teachers; what, where, when and how of integrating it is the most difficult task. What, why, when and how of integration were the buzz questions during the training programme.

Part to whole method was tried out in a systematic way wherein the teachers were reminded of the structure of science, scientific methods, Science processes, Science related values as a first step. These helped them recall various methods, their merits and demerits through various activities. Hands on experience with various softwares/ technologies especially deliberations on why, when and how of using them in the classroom teaching were discussed. As a result they were able to integrate them in making a lesson interesting and complete in its own sense.

Conclusion

Exposure, updation and practice would help in strengthening the knowledge base of teachers. Providing opportunity to share, explore and contemplate on the practices would improve their teaching learning process.

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