TEACHERS' UNDERSTANDING OF TEACHING-LEARNING SITUATION AND INSTRUCTIONAL PRACTICES IN CHEMISTRY TEACHING

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Abstract

The main aim of this study is to investigate understanding of high school chemistry teachers and their instructional practices in chemistry teaching. In this paper, questionnaire survey method, one of the descriptive methods, was used. Forty-eight high schools were selected with the adoption of stratified random sampling technique from Yangon Region. The participants of the sample were high school chemistry teachers. In order to get the required data, the questionnaire having sixty items with five point Likert-type scales and demographic data were developed. The questionnaire was based on five dimensions for teachers' understanding: teaching profession, curricular context, instructional strategies, students' learning needs and assessment. The questionnaire for instructional practices was based on three dimensions: structured practices, student-oriented practices and enhanced activities. The internal consistency of the pilot test was 0.837 and 0.8. The collected data of this study were systematically analyzed by Statistical Package for the Social Science (SPSS) software version as it is widely used in quantitative research. The descriptive analysis techniques were used to tabulate percentages, means and standard deviations. The results showed that the percentages of moderate level of chemistry teachers' understanding were more than high and low level of understanding teaching and learning aspects. According to Pearson product moment correlation result, it was found that there was a positive, moderate relationship between chemistry teachers' understanding of teaching-learning situation and instructional practices, (r=.391).It can be interpreted that teachers' understanding conveyed the associated ideas in chemistry teaching.

Keywords: understanding, instructional practices, teaching, learning

Introduction

Education is one of the essential tools for national development. The level of socio-economic development in the country is strongly connected to education. It is generally accepted that the quality education leads to economic growth hence reduced poverty, improve health and generate creative citizens. Myanmar is striving for quality education by advocating for quality teaching method that can make positive impact on learners through pre-service and in-service teacher education at all levels, to reach the ultimate goal of creating scientifically literate citizens. And thus, teachers' understanding in the meaning, functions and objectives of education are very crucial as a role in implementing the goals of education. Sullivan (1996, cited in Loughran et al, 2012) said that one of the pre-requisite to be good teacher is to understand the teaching and learning process in more depth. And this will facilitate better appreciation of the teaching profession as well as the process of imparting education.

Teaching is an art depending on the individual teacher' skills in using various teaching methods to suit the subject, topic and the students. The most changes that are impinging in education are science and its application. Chemistry education is also necessary because of its value in the students' individual life as well as in society. And thus, there is a need for a shift of emphasis in the teaching of chemistry.

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Purposes of the Study

The main purposes of the study are

(1) to inquire teachers' understanding of teaching-learning situation in chemistry teaching

(2) to investigate the relationship between chemistry teachers' understanding of teaching-learning situations and their instructional practices

(3) to give suggestions for improving chemistry teaching and professional development of chemistry teachers

Research Questions

According to the above research purpose, the following research questions were posed;

(RQ 1) To what extent do chemistry teachers understand teaching and learning ideas?

(RQ 2) To what extent are teachers' understanding conveyed during chemistry teachers' instructional practices?

(RQ 3) What is the relationship between science teachers' understanding of teaching learning situations and their instructional practices?

These questions explore what and how explicit teaching and learning ideas are conveyed during regular chemistry instruction, and what relationship exists betweenteachers' understanding and teaching of chemistry.

Scope of the Study

(1) This study is geographically restricted to Yangon Region.

(2) Participants in this study are chemistry teachers from the selected schools within the school year (2018-2019).

(3) Forty-eight high schools are selected for this study.

(4) Grade ten and grade eleven chemistry teachers are chosen for this study.

(5) Among Stephen Marble, Sandy Finley, and Chris Ferguson, 2000, five components of teacher's understanding on teaching and learning (curriculum context, instructional strategies, assessments and student's data use and vision of teaching) are used. Three dimensions (structured practices, student-oriented practices, enhanced activities) developed by OECD (Organization for Economic Cooperation and Development, 2009) are used for instructional practices.

Definition of the Key Terms

Understanding: Understanding involves obtaining a mental grasp of events, that is, a framework of knowledge that spins off into practical suggestions, theoretical considerations, estimates of worth (Scriven, 1976, cited in Loughran, 2012).

Instructional practice: Those actions exhibited by teachers in class intended to bring about a change in behavior in the students (Beccles, 2012, cited in Alam, 2014).

Teaching: Teaching is best described as guiding and directing the learning process such that learners acquire new knowledge, skills, or attitudes, increase their enthusiasm for learning, and develop further their skill as learners (Newcomb et al, 1986, cited in Alam, 2014).

Learning: Learning is the process of acquiring, altering, and abandoning conceptions or understandings (Murphy & Mason, 2000).

Background of the Study

Chemistry in school is part of the total education provision and the chemistry content is gained so as to enhance learning in the cognitive, personal and social domains. The teaching of a sequence of chemistry lessons begins from a relevant socio-scientific context. The teaching progresses from the societal (the familiar) to the chemistry concepts (the unknown) which are needed to better appreciate the issues, or concerns, and then proceeds to the socio-scientific decision making needed (the purposeful learning involving all educational domains). Teaching geared to the goals of education covers a wide range of intended targets in the intellectual, personal and social domains. Conceptual learning within the subject needs to be approached in a relevant manner, but also the teaching must not lose sight of the fact that the attitudes, communication abilities and personal attributes (such as creativity, initiative, safe working) need to be developed. Teachers need to recognize that curricula promoting chemistry fundamentals, grouping chemistry concepts for scientific convenience.

Chemistry is a difficult subject to teach and to learn at both secondary and tertiary levels. Major learning difficulties are due to the particular views of chemistry phenomena that in many ways contradict intuitive and everyday views of the learners. As a result, major misunderstandings occur when students try to comprehend chemical explanations within the framework of their pre-instructional conceptions in the domain of chemistry and on attempts to guide students from their conceptions to the core ideas of chemistry. Understanding and learning core science concepts and principles, including those in chemistry, are difficult.

Teachers need in the continuous development of understanding about the current trends of chemistry teaching and learning to include both the content and pedagogy of chemistry learning and teaching. Effective teachers exhibit a breadth of knowledge, bring information together from a variety of sources, analyze concepts effectively, and stay up to date in their specialty. The predispositions and understandings that teachers hold are both consciously and unconsciously replicated in their own classrooms during teaching.

Teachers' conceptions of teaching and learning, and of how these are related to students' approaches to learning, seem to be paramount in enhancing the quality of learning. Effective pedagogy requires learning to be scaffolded. A major contribution to such scaffolding derives from teachers' understanding of both curricular knowledge and of how children and young people learn. The teacher must know when learning is correct or incorrect, learn when to experiment and learn from the experience, learn to monitor, seek and give feedback, and know to try alternative learning strategies when others do not work. In a framework of continuous learning, it is necessary for a teacher to be well conversant with the latest pedagogical know-how. New pedagogical approaches such as cooperative learning, reciprocal learning, inquiry based learning, project based learning on learner-centered should be adopted by 21st century teachers.

The 21st century world has become increasingly complex. For example, the way people communicate with one another has been unequivocally altered by communication technologies that connect individuals in multiple networks. In education, the approach to reforming school

systems requires appreciating the complexity of teaching and learning that exist among and between students, schools, and larger communities.

Significance of the Study

Chemistry students are unable to perceive relationships among components of chemistry subjects. The aim of any school chemistry curriculum is not only to educate in chemistry but also to educate through chemistry. The aim has to generate a population that is informed about chemistry and its importance in modern day society, a population who are positively disposed to chemistry and its impact in society. Teachers need awareness of students' limited understanding of complex ideas in chemistry and to be able to inspire good attitudes toward learning chemistry. The achievement of chemistry outcomes largely depends on teachers' interpretation and use of teaching strategies according to the students' needs.

Only if teachers understand teaching and learning situations, their efforts seem well in shaping the track of students' interests to chemistry subject. Active learning is promoted by learning outcomes related to chemistry process skills. At present times, it is found that students do not achieve chemistry process skills and they face difficulties in higher academic courses. Therefore, teachers must be well-versed with chemistry teaching and learning to fulfill the needs of the students. If not they understand the teaching and learning process well, they cannot interpret the components of chemistry effectively. Teachers must have understanding of learning needs and desire to fill these needs with the understanding of the connections of curriculum, instruction and assessment. As teachers develop a reliance on their understanding of and focus on student learning, they also begin to feel that they have a significant impact on the learning that goes on in their classroom. Collectively, these studies indicate that teachers' limited understanding of teaching and learning systems remains an educational problem.

Review of Related Literature

Theoretical Framework of Pedagogy

Teachers' use of communicative strategies encourages pedagogic practices that are interactive in nature, and is more likely to impact on student learning outcomes and hence be effective. Pedagogic practice is developed through interaction between teachers' thinking or attitudes, what they do in the classroom and what they see as the outcome of their practice. These attitudes were teachers' positive attitudes towards their training and their students, which positioned them in the best frame of mind to construct the teaching and learning process as an interactive, communicative process in which teaching involved provoking a visible response in their students that indicated that learning was taking place. Six specific strategies that promoted this interactive pedagogy were identified in the Education Rigorous Literature Review (2013, cited in Westbrook et al, 2013) include the following factors;

- feedback, sustained attention and inclusion;
- creating a safe environment in which students are supported in their learning;
- drawing on students' backgrounds and experiences.
- flexible use of whole-class, group and pair work where students discuss a shared task;
- frequent and relevant use of learning materials beyond the textbook;
- open and closed questioning, expanding responses, encouraging student questioning;
- demonstration and explanation, drawing on sound pedagogical content knowledge;

- use of local languages and code switching;
- planning and varying lesson sequences.

Understanding Teaching and Learning

Today, teaching is often viewed as a routine function, tacked on, something almost anyone can do. Great teachers create a common ground of intellectual commitment. They stimulate active, not passive, learning and encourage students to be critical, creative thinkers, with the capacity to go on learning. Indeed, as Aristotle said teaching is the highest form of understanding. Marton and Booth (1997) said that teaching as a scholarship enterprise involving the development of a knowledge of practice through building of bridges between teacher's understandings and students' learning. And also Entwistle (1998) said that it includes teachers' understanding research on student learning and deploying this knowledge in their approaches to teaching. (Marton & Booth, 1997, Entwistle, 1998, cited in Fry et al, 1999)

Teachers' perspectives on curriculum, assessment, instruction and their profession are important for the students in receiving a coherent message about what is important to learn and are assessed in a manner consistent with instruction. Ball and Cohen (1999) discussed teachers' learning, saying

"The knowledge of the subject matter, learning, learners, and pedagogy is essential territory of teacher's work if they are to work as reformers imagine, but such knowledge does not offer clear guidance, for teaching of the sort that reformers advocate requires that teachers respond to students' effort is to make of material. To do so, teachers additionally need to learn how to investigate what students are doing and thinking, and how instruction has been understood, the best way to improve both teaching and teacher learning would be to create the capacity for much better learning about teaching as a part of teaching" (Ball and Cohen, 1999, cited in Stephen et al, 2000).

Understanding on Students' Learning

A typical classroom activity focuses on a segment of a curriculum topic such as a significant concept, understanding, principle or skill (Wells, 2002b, cited in Kaur, 2012). Several different patterns of classroom organization might be involved. The parts of an activity (such as a whole-class discussion, completing a worksheet, conducting an experiment) are themselves activities that have their own expected components and make a specific contribution to the larger activity. Further, students tend to interweave elements of the smaller activities so that it is impossible to identify when one ends and the next one begins.

The processes of understanding, knowledge acquisition, internalization and memory are closely linked and related to individual differences in what is learned and remembered. If the concept of an activity is to provide a useful unit of analysis for understanding the conditions under which higher mental processes are acquired, then its theoretical basis needs to be expanded to incorporate the cognitive representations of activities (scripts and schemas) that have proved useful in explaining memory processes. Sheull (1993) said that it is important to remember that what the student does is actually more important in determining what is learned than what the teacher does. This statement is congruent with a constructivist view and reminds teachers that students in higher education must engage with and take some responsibility for their learning.

According to Vygotsky (1978), and other sociocultural theorists (Arievitch & Van Der Veer, 1995), the higher mental processes (involved in learning from experience) are generated through the internalization of culturally structured social activities (Sheull, 1993, cited in Kaur, 2012). Children acquire cognitive processes as part of acquiring the culture of the society in which they live, progressively, through constant guided participation in the activities and rituals that make up daily life. Through participation, they internalize the goals and purposes, the behaviors, and the knowledge and thinking processes involved in the activities.

The basis of a series of cross-cultural studies of children's development, that school, unlike other social institutions, requires the systematic and managed use of cognitive activities. What is unknown is how participation in school activities shape the way the child interprets, thinks about and uses experience (Nuthall, 2000, cited in Kaur, 2012). The process by which social activities become mental processes is referred to as internalization (Lawrence & Valsiner, 1998, cited in Kaur, 2012).

Chemistry in Science Education

Chemistry is the science of matter and its transformations. Investigation should be prominent in any science curriculum. Most of the big ideas in chemistry and other sciences were developed over many years of investigation. Experiments should be performed in the high school chemistry teaching.

Students should be exposed to the wonderful nature of science in general, and how chemistry relates to other sciences and other subjects in the high school curriculum. Frazer, 1975, claimed the general aim of chemistry should be like

- to prepare students for professional career in science especially in chemistry
- to contribute to general education using chemistry as an instrument and
- to inform future citizens of the country of the nature and the role which chemistry plays in everyday life (Frazer, 1975, cited in Matthews, n.d.)

High school chemistry teachers should strive to model and emphasize the inquiry, scrutiny, and information-sharing that is fundamental to the practice of science. Scientifically literate chemistry students should be able to describe the concepts and how the value could be investigated, verified, or applied. Students should be able to carry out such an investigation. Advance planning is crucial for active student engagement in learning. Chemistry teachers should first decide on the conceptual leaning goals for their students, focusing on broad concepts within the big ideas in chemistry. Spiraling the curriculum, building on and making connections to what students already know, will encourage student participation and understanding.

Method and Procedure

Research Design

The research design for this study was a descriptive research design, in which it is used to determine whether, and to what degree, a relationship exists between two quantifiable variables. In this study, data were collected through a quantitative method. Quantitative method is research technique that is used to gather quantitative data-information dealing with numbers and anything that is measurable (Gay & Airasian, 2003).

Instruments

In this study, two instruments were used for data collection. Both instruments, teachers' understanding inventory and instructional practices index. Teachers' understanding was developed by Stephen Marble, Sandy Finley, and Chris Ferguson, 2000 and instructional practices was developed by OECD (Organization for Economic Cooperation and development), 2009. To investigate the teachers' understanding and instructional practices both instruments were modified into Myanmar version and used.

Teachers' understanding inventory was constructed with total 40 items consisting five dimensions of curricular context (8 items), assessment (8 items), students' learning needs (8 items), instructional strategies (8 items) and teaching profession (8 items). It is a five point Likert scale ranging from (1), 'strongly disagree', (2) 'moderately agree', (3) 'undecided' (4), 'agree', and (5) 'strongly agree'.

Instructional practices inventory included 20 items that represented three dimensions structured practices (10 items), student-oriented practices (6 items), and enhanced activities (4 items). The response type for each item is a five point Likert scale: 'never' (1), 'seldom' (2), 'sometimes' (3), 'often' (4) and 'always' (5).

Table 4.1 Level of Chemistry Teachers' Understanding Teaching and Learning Aspects

Understanding Teaching and Learning Aspects	Level of Understanding	Frequency	Percent
Understanding Teaching Profession	High	17	11.8
	Moderate	100	69.4
	Low	27	18.8
	Total	144	100
Understanding Curricular Context	High	26	18.1
	Moderate	93	64.6
	Low	25	17.4
	Total	144	100
Understanding Instructional Strategies	High	20	13.9
	Moderate	101	70.1
	Low	23	15.9
	Total	144	100
Understanding Students' Learning Needs	High	33	22.9
	Moderate	101	70.1
	Low	10	6.5
	Total	144	100
Understanding Assessment	High	23	15.9
	Moderate	108	75
	Low	13	9.0
	Total	144	100

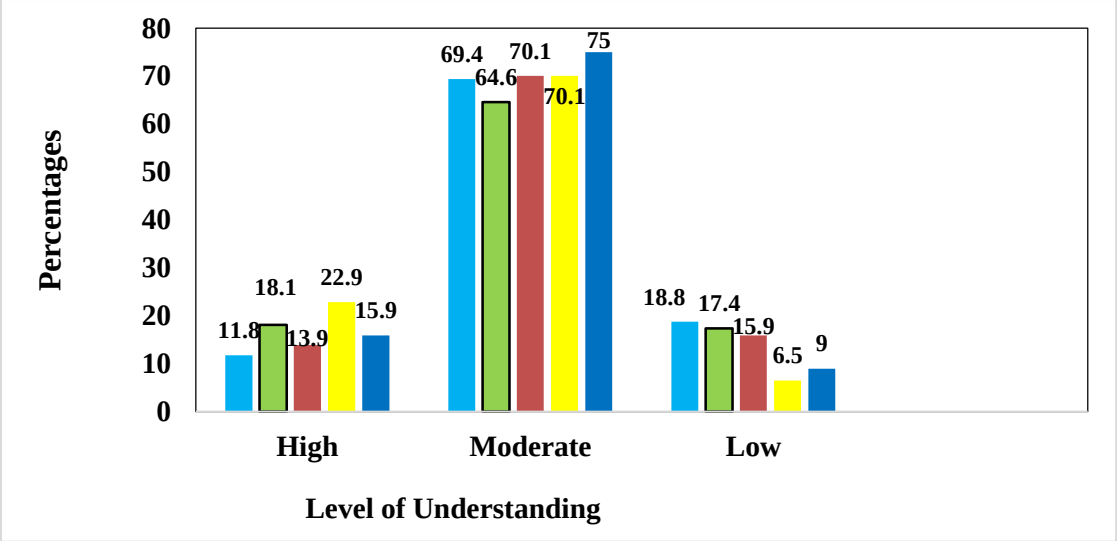

Figure 4.1 Level of Chemistry Teachers' Understanding of Teaching-Learning Aspects

Table 4.1 and figure 4.1 showed the percentages of chemistry teachers categorized into five dimensions of understanding teaching and learning aspects. According to the tale and figure, 11.8% of the chemistry teachers were identified as high-level group in understanding teaching profession, 18.1% of the teachers in understanding the curricular context, 13.9% of the teachers in understanding instructional strategies, 22.9% of the teachers in understanding students' learning needs and 15.9% of the teachers in understanding the assessment. 69% of the chemistry teachers were moderate in understanding teaching profession, nearly 65% of the teachers in understanding curricular context, 70% of the teachers in understanding instructional strategies, 70% of the teachers in understanding the learning needs and 75% of the teachers in understanding the assessment. Then, nearly 19% of the teachers were low in understanding teaching profession, 17.4% of the teachers in understanding the curricular context, 15.9% of the teachers in understanding instructional strategies, 6.5% of the teachers in understanding learning needs and 9% of the teachers in understanding the assessment. There was little difference in percentages of high and low level of understanding teaching and learning aspects. In all dimensions, the percentages of moderate level of understanding are more than high and low level of understanding teaching and learning aspects.

Table4.2 Means and Standard Deviations for Ten Items of Structured Practices

No	Items	N	Means	Std. Deviation
1.	Item 1	144	3.89	0.86
2.	Item 2	144	3.67	1.05
3.	Item 3	144	3.94	0.99
4.	Item 4	144	4.01	0.99
5.	Item 5	144	4.26	0.76
6.	Item 6	144	4.03	0.85
7.	Item 7	144	3.90	0.89
8.	Item 8	144	3.65	1.05
9.	Item 9	144	4.20	0.73
10.	Item 10	144	2.60	0.72
	Overall	144	3.82	0.54

Scoring Direction: 1.00-1.49=never, 1.50-2.49=seldom, 2.50-3.49=sometimes, 3.5-4.49=often, 4.50-5.00=always

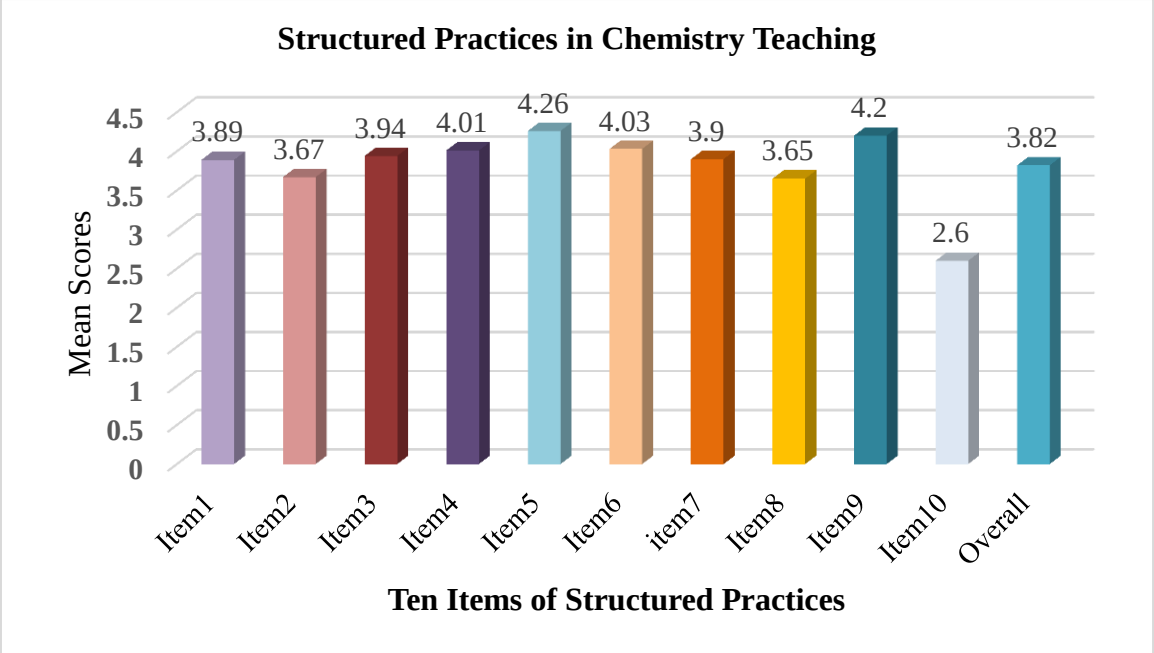

Figure 4.2 Mean Comparison for Ten Items of Structured Practices in Chemistry Teaching

According to table 4.8 and figure 4.3, it could be noted that the item (Check students' exercise books regularly) had the highest mean score (M=4.20). And, the item (questions are made to the application level and higher performance level of the students in checking students' understanding of subject matter) had the lowest mean score (M=2.60). Based on this result, it can be noted that teachers used to check the knowledge and comprehension level of students in questioning.

Table 4.3 Means and Standard Deviation for Chemistry Teachers' Student-Oriented Practices

No.	Items	N	Means	Std. Deviations
1.	Item 1	144	3.4	0.97
2.	Item 2	144	3.1	1.07
3.	Item 3	144	3.2	1.05
4.	Item 4	144	3.27	0.87
5.	Item 5	144	3.22	0.84
6.	Item 6	144	3.03	1.02
	Overall	144	3.21	0.74

Scoring Direction; 1.00-1.49=never, 1.50-2.49=seldom, 2.50-3.49=sometimes, 3.50-4.49=often, 4.50-5.00=always

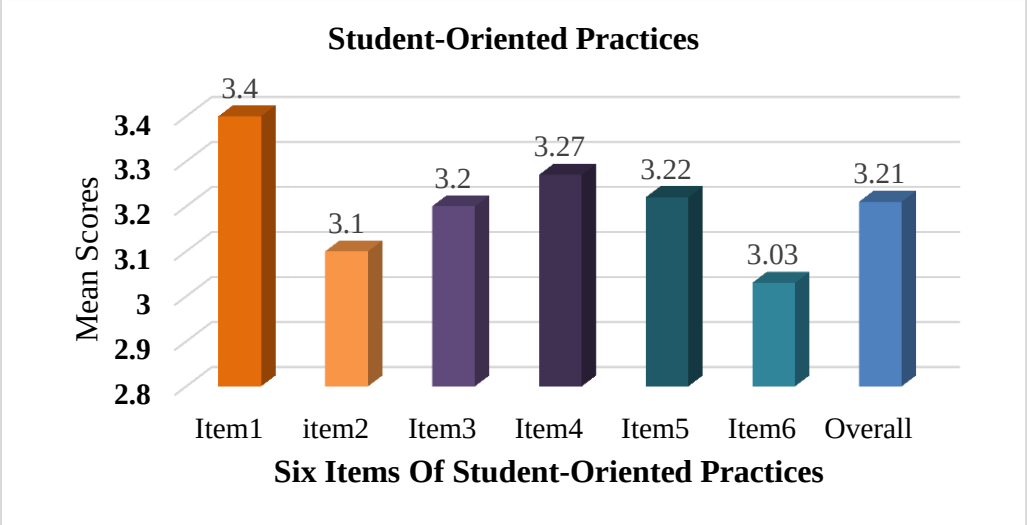

Figure 4.3 Mean Comparison for Six Items of Student-Oriented Practices

In the table 4.3 and figure 4.3, the item (Have students work with concrete materials or manipulative) had the highest mean score (M=3.4) which was equivalent to "sometimes" mark on scale. So, it is found that chemistry teachers sometimes use the concrete materials in teaching chemistry lessons. And, the item (Give enough time for reflective evaluation) had the lowest mean score (M=3.03) finding that chemistry teachers sometimes give enough time for students to reflect evaluation. Moreover, Others items which the mean scores are above 3.0, equivalent to "sometimes" mark mon scale.

Table 4.4 Means and Standard Deviations for Enhanced Activities in Chemistry Teaching

No.	Items	N	Means	Std. Deviation
1.	Item 1	144	1.76	0.92
2.	Item 2	144	1.94	0.99
3.	Item 3	144	2.7	0.89
4.	Item 4	144	2.7	0.87
	Overall	144	2.27	0.72

Scoring Direction: 1.00-1.49=never, 1.50-2.49=seldom, 2.50-3.49=sometimes, 3.50-4.49=often, 4.50-5.00=always

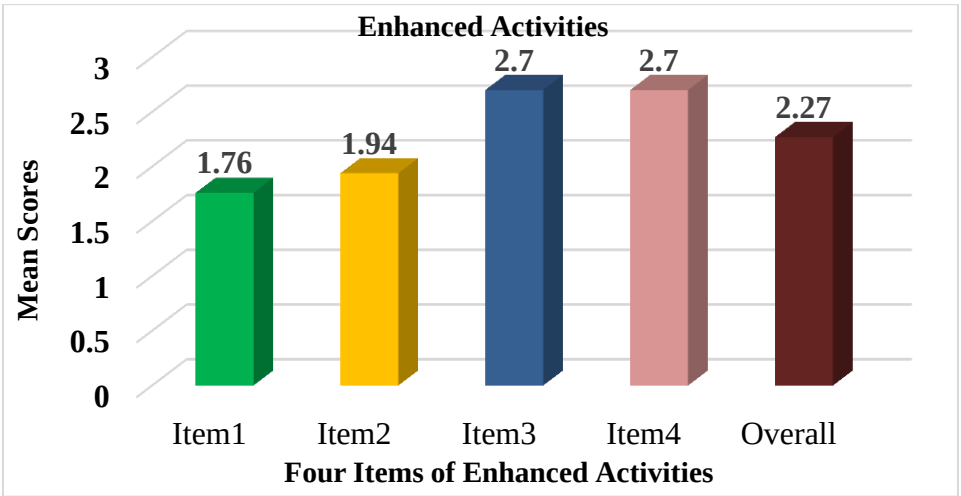

Figure 4.4 Mean Comparison for four items of enhanced activities

According to the table 4.4 and figure 4.4, the item (Writing essay to assess students' thinking and reasoning skills) and the item (Have students debate and evaluate upon an opinion) had the highest mean score (M=2.7). Thus, it could be noted that chemistry teachers have more strength upon making students writing essay and debate on an opinion in the practices of enhanced activities. And, the item (working a project at least one week to complete) had the lowest mean score (M=1.76). Thus, it could be noted that chemistry teachers have more strength upon making students writing essay and debate on an opinion in the practices of enhanced activities than practicing students doing investigation.

Table 4.5 Correlations between Chemistry Teachers' Understanding of Teaching and Learning Aspects and Instructional Practices

		Chemistry Teachers' Understanding of Teaching and Learning Aspects	**Chemistry Teachers' Instructional Practices**
Chemistry Teachers' Understanding of Teaching and Learning Aspects	Pearson Correlation	1	.391**
	Sig. (2-tailed)		.000
	N	144	144
Chemistry Teachers' Instructional Practices	Pearson Correlation	.391**	1
	Sig. (2-tailed)	.000	
	N	144	144

**. Correlation is significant at the 0.01 level (2-tailed).

To examine the relationship between teachers' understanding and instructional practices, Pearson product-moment correlation was used. A correlation indicates that the size and direction of a relationship. A correlation coefficient is a decimal number ranging from (+1.00) to (0.00) to (-1.00). A coefficient near (+1.00) has a high size and a positive relationship. If the coefficient near (0.00), the variables are not related. A coefficient near (-1.00) has a high size and negative or inverse direction. A coefficient below plus or minus (0.35), low or not related; coefficient between plus or minus (0.35) and (6.5), moderately related; and coefficient higher than plus or minus (.65), highly related (Gay &Airadian, 2003).

According to the Table 4.5, there is significant relationship between chemistry teachers' understanding of teaching and learning aspects and their instructional practices. And, it is found that there is moderate relationship between chemistry teachers' understanding and instructional practices.

Discussions, Suggestions and Conclusion

Discussions

The main purpose of this study was to investigate teachers' understanding of teaching and learning aspects in chemistry teaching. Therefore, an investigation is conducted by using the quantitative method. As a sample, a total of 144 senior assistant chemistry teachers were selected. A survey questionnaire was used to elicit the responses from chemistry teachers to know their understanding on teaching and learning aspects and the extent their understanding conveyed during their instructional practices.

For the first dimension, it was found that chemistry teachers have positive professional vision of teaching resulting the total mean score "3.99". They expressed positive perceptions on the items (teaching profession is important in society, professional development activities are not conflict with their work, teaching is the application of skills in real situations, the capacities of a teacher must improve continuously, teaching is a collegial act best done in collaboration with others, classroom teaching makes the teacher more creative) which have the mean scores above "4.0" and "3.5".

And they expressed "undecided" in the items (Professional development activities are too expensive and unaffordable for teachers and students' success and instructional decisions depend on external factors) which have the mean scores above "3.10" and "3.33".

For the second dimension, chemistry teachers claimed that they have understanding on curricular context resulting the total mean score "4.04". They have positive perceptions on all the items resulting the mean scores above "4.0" and "3.5".

For the third dimension, chemistry teachers claimed that they have understanding on the aspects of instructional strategies resulting the total mean score "4.1". They expressed positive perceptions on the items (my role as a teacher is to facilitate students' own inquiry, I rely on the teacher's guide-book as the source of authority for instructional strategies, chemistry teachers should strive to model the effective teaching methods, some chemistry lessons can be taught by observation method and student-centered teaching method, some chemistry lessons can be taught by the demonstration method to facilitate students' leaning, I understand the teaching procedures involved in student-oriented instruction) resulting the mean scores above "4.0" and "3.5".

And they claimed "undecided" in the items (I need knowledge of chemistry teaching strategies and a laboratory lesson consists of three steps) which have the mean scores "2.5" and "2.57".

For the fourth dimension, chemistry teachers claimed that they have understanding on the students' learning needs showing the total mean score "4.11". They expressed positive perceptions on the items (the higher mental processes of students are generated through the internalization of culturally structured social activities, teachers must consider what each task or activity will require of students, students differ learning styles according to their individual differences, linking the prior knowledge with the new information causes meaningful learning, the teacher must know the points in which students get misconceptions and learning the scientific terms and formulas is more important before teaching scientific concepts and principles) all showing the mean score above "4.0".

For the fifth dimension, assessment is an integral component of teaching and learning system. A large number of assessment methods are available for use in education. Assessment of student learning requires the use of a number of techniques for measuring student achievement. Chemistry teachers claimed that they have understanding the assessment aspects resulting the total mean score "4.16". They expressed positive perceptions on all the items showing the mean scores above "4.0" and "3.5".

According to findings from this study, high, moderate and low level of understanding teaching and learning aspects are found. For the first dimension, it is found that 11.8% of chemistry teachers were at high level, 69.4% of teachers were at moderate level and 18.8% of teachers were at low level of understanding teaching profession. For the second dimension, it is

found that 18.1% of chemistry teachers were at high level, 64.6% of teachers were at moderate level and 17.4% of teachers were at low level of understanding curricular context. For the third dimension, it is found that 13.9% of chemistry teachers were at high level, 70.1% of teachers were at moderate level and 15.9% of teachers were at low level of understanding instructional strategies. For the fourth dimension, it is found that 22.9% of chemistry teachers were at high level, 70.1% of teachers were at moderate level and 6.5% of teachers were at low level of understanding students' learning needs. For the fifth dimension, it is found that 15.9% of chemistry teachers were at high level, 75% of teachers were at moderate level and 9% of teachers were at low level of understanding assessment. Therefore, based on the results finding, it can be interpreted that most teachers do not have complete understanding about the teaching and learning aspects.

This may have been a result of a lack of professional development or a lack of effort in promoting professional development to enhance teachers' subject matter knowledge and PCK (i.e, how to teach and apply the tools and resources of teaching). The idea of PCK was enticing because it seemed to be such a clever way of imagining what the specialist knowledge of teaching might involve. PCK conjured up an image of cutting-edge knowledge of practice, something special and important, something that could define expertise, something that could illustrate in a meaningful way why teaching needed to be better understood and more highly valued.

The findings of instructional practices showed that structured practices are emphasized more than student-oriented practices and there was totally absent the practices of enhanced activities. There are ten items of structured practices corresponding to the teacher-centered teaching included state learning goals, review students' homework they have prepared, present a short summary of the previous lesson, check students' exercise book and lecture and check by asking questions. Based on the results, 44.5% of chemistry teachers expressed "often do" and 26.3% of the teachers expressed "always do".

According to the findings of student-oriented practices, 34.2% of the teachers expressed "often do" and 7.9% of the teachers expressed "always do". The mean scores of student-oriented practices for the whole sample is found all above "3.0." Therefore, it can be interpreted that chemistry teachers do not still emphasize student-oriented practices. The findings of enhanced activities show that 10.3% of the teachers is found "often" and 1.4% of the teachers is found "always." The mean scores of the enhanced activities show that "1.76" and "1.94" in the items (work on project at least one week to complete and students make product that others can use). This finding described that higher performance of students' capacities were not totally absent in chemistry teaching. Teachers need to change the pattern of questioning from the traditional way of checking students' knowledge. In order to increase interaction, science teachers need to set hands-on activities, group or peer work, subsequent student presentations and discussions. Thus, students need to be encouraged to liberally participate in such activities and willingly express their thought.

PCK had a dramatic impact on teachers' understanding of practice. The items (writing essay to evaluate students' thinking and reasoning skills and hold a debate upon an opinion) had the mean scores "2.7" and "2.2." This finding shows that chemistry teachers are weak in their teaching practices of chemistry teaching. As a consequence, it was reminded of how limited understandings of a specific topic inhibit the ability to create the amalgam of content and

pedagogy that is PCK. In addition, the essence of PCK is not captured by mere representations of teachers just "knowing what to do" or "how to do it". Teaching is complex work and many teachers come to find that their initial simplistic views of teaching are confronted when the intricacies of their work become clearer over time. Through this process, whereby a growing understanding of teaching begins to emerge largely as a result of learning through experience, a new appreciation of one's skills and abilities compels some to move beyond the simple delivery of information.

The present findings, however, show that regular science classrooms have not yet to benefit from these commendable efforts. It is perhaps time for the science education research community to re-examine and focus on the translation and scaling up of these pieces of promising reform to science classrooms. The development of instructional resources, curricula and strategies aimed at facilitating the teaching of science required for the professional development of chemistry teachers. Results from survey responses and detailed analysis suggest that there is a relationship between science teachers' understanding of teaching and learning systems and their instructional practices of chemistry teaching. From the surveys, a positive, moderate and significant association between chemistry teachers' understanding and their indications of incorporating teaching and learning ideas in their instructional practices was obtained. This finding pointed out that there is a moderate relationship between teachers' understanding of teaching and learning ideas and their instructional practices conveying the associated ideas. In this study, it is found that chemistry teachers have understanding on their teaching profession, curricular context, instructional strategies, students' learning needs and assessment. It will get better expectations on quality teachers if chemistry teachers have more thorough understanding of teaching profession, the connection between curriculum, assessment and instruction.

Suggestions

This study was restricted to the sample of population from the selected schools in Yangon region. The participants were only 144 chemistry teachers from forty-eight high schools. It can be conducted future research based on the findings of this study by using larger sample size of participants in different high schools, primary and middle schools, colleges and university. Video-observation method should be applied in further research to find out teacher-student interaction more definitely. Besides, interview method should be undertaken in order to build rapport between the researcher and the subjects.

Stephan Marble, Sandly Finley and Chris Ferguson (2000), made a framework for over a year with groups of teachers in five sites to examine their perspectives, experiences, and understanding about teaching. They created opportunities for teachers and their colleagues to carefully reexamine how children learn. In the safety of these collegial communities, teachers developed their confidence and refocused their practices. Most importantly, they moved from a habit of thinking mostly about the instructional problem to a habit of thinking first about the learner. This turn to learning opened doors to an extensive rethinking of teachers' understanding and approaches to teaching. Huberman (1995) said that collegial learning in school networks has emerged as a way to promote professional development. This suggests that helping teachers build new connections and relationships requires intense and honest engagement.

Teachers need a wide array of information, materials, and requirements to develop the deep understanding necessary to make instructional decisions that promote students' learning. Teachers should be better able to understand and consider the importance of making the connections between curriculum, assessment and instruction for the learner. Therefore, further research should focus on what teachers do in the classrooms since content coverage and instructional strategies are the predominant theme of most curricular and professional development reforms. For teachers, designing a classroom assessment required to understand establishing clear targets in conjunctions with selecting important content for students to learn and appropriate instructional strategies to support their learning. Understanding of the connections help teachers see the need to focus on student learning. Therefore, it is important to build on teachers an understanding of how it is related to the other parts of the system. Chemistry teachers need to engage in many professional development activities such as attending courses and workshops, self-study, practicing, collaboration and observation. Professional development of chemistry teachers is necessary to enhance their capacity in teaching practices and to improve the current situation.

At the current trend of reform education, chemistry teachers face the challenges such as teaching methods, their teaching proficiency, and ways to motivate their students. For facing challenges to gain real traction in school science instruction, it requires reform efforts over extended time and at several levels, students and teachers, curriculum and learning and teaching resources, and school and district organizational support. This is in itself a complex endeavor, an endeavor the science education community should strive to continue working on. This will require the provision of time when teachers can meet to discuss new information with colleges and to test, reflect on and evaluate its effectiveness in the classroom.

Short-term intensive workshops are needed in upgrading teachers' content knowledge, and in their acceptance of the ideas behind an innovation. Current efforts in addressing the educational problem of quality education have largely focused on promoting quality teachers. Therefore, the science education and research community should place equal emphasis on the teachers and the teaching of science, and not simply on the learners and the learning of this domain. It is also necessary to bear in mind that the professional development efforts should not only help promote teachers' understanding of teaching and learning but also provides strategies and approaches they can use to facilitate their students' conceptions. Other professional trainings should address all the aspects of modern teaching-learning in a packaged programme so that the teachers can have a complete idea about modern approach of teaching.

The educational stakeholders should fairly consider vulnerable condition of science education depicts also the shortage of laboratory, availability of the laboratory equipment, shortage of science teachers and trained science teachers in Myanmar. The challenges for improving the quality of the education system, however, are significant, including low learning levels, inadequate acquisition of non-cognitive skills, inequitable learning among students, a high degree of variation between schools, low teacher motivation, low time on task, weak examinations and teacher development systems.

It is found that the understanding of facilitation, dialogue, and reflection is not widespread among those who currently work with preservice and in-service teachers. This way of working represents a paradigm shift for many of those who would assist teachers, including school district and university faculty. Therefore, the educational reformers need to learn more

about what these educators require to be better able to facilitate groups of teachers in ways that promote the construction of more coherent practices.

Conclusions

The results regarding teachers' understanding of teaching and learning have revealed that in Myanmar high school chemistry teachers' understanding regarding teaching and learning did not partition within a particular dimension. Less than half of the chemistry teachers of the researched schools have low level of understanding regarding teaching-learning and more than half of the chemistry teachers hold moderate level of understanding. Only 20% of the teachers hold high level of understanding teaching and learning aspects.

The 21st century is one of complexity and complex systems science has garnered tremendous attention from scientists and policymakers. This field has influenced several science education reform documents over the past decade and science educators and researchers have advocated complex systems instruction in school science for better science understanding.

The empirical finding of the reasons hindering teachers' understanding also hints that a coordination of efforts – within and beyond professional development – will be required to carefully address the educational problem. From providing more learning opportunities and exposure to science teaching for teachers and students, designing teaching and learning aids to visualize the obscure nature of underlying mechanisms of science subjects, to putting more prominence to teaching in existing science syllabi and assessments, these efforts can help alleviate some of the challenges science teachers face in understanding and teaching science, especially, in chemistry teaching.

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