ISSN: 2278-4012, Volume:2, Issue:4, OCTOBER 2013

A Typology of Teaching Styles among Chemistry Secondary School Teachers

Winnie Sim Siew Li[1]

Mohammad Yusof Arshad[2]

[1, 2] Department of Educational Sciences, Mathematics and Multimedia Creative,
Faculty of Education,
University Technology Malaysia

Abstract*: Teacher is a prominent person in classroom. Teaching styles will determine how teachers set their direction and focus in teaching. This article investigates teaching styles among Malaysian chemistry secondary school teachers via verbal interaction. Characteristics of these teaching styles were determined in order to make comparison among different teaching styles. Twenty three of chemistry secondary school teachers and their students in Kuala Lumpur were involved in this study. Non-participant observation was applied. Ninety two classroom observations were audio and video recorded. Besides that, semi-structured interview with the teachers were carried out. Data were analysed using cluster analysis to identify their teaching styles. Findings from this study found that in laboratory lessons, 95.65% of the teachers' emphases were on group activities and teacher's explanation or instruction. Meanwhile, 65.22% of the teachers showed teacher-centred approach, i.e. giving explanation in theory lessons. Characteristics of the teaching styles were investigated in terms of type of teacher's question and student's question. Regardless of teaching styles, teacher's questions and students' questions were of closed-ended questions, and managerial questions. Based on the findings, teaching style for chemistry lesson is proposed.*

Keywords: *teaching styles, verbal interaction, teacher's question, student's question*

Introduction

There are many previous researches done on classroom interaction. Yet, at this moment, there are still researches on this aspect. Classroom interaction research is an important aspect to be investigated as it is an ongoing process of teaching and learning either in formal context or informal context. Classroom interaction can either occur verbal or non-verbal (Rohizani, Sahabuddin and Mohd. Zohir, 2003). In this study, focus is on verbal interaction as teaching and learning process in classroom involves verbal interaction (Clamberlain and Llamzon, 1982; Myhill and Dunkin, 2005). In classroom, interaction may occur between teacher and students or between student and other student(s)(Brown, 1975). There are three main components in classroom interaction, which are teacher talk, student talk or silence (Flanders, 1970); or the third component as silence or confusion as stated by Mohamed Najib (1997). The first two

ISSN: 2278-4012, Volume:2, Issue:4, OCTOBER 2013

components represent verbal interaction. The third component, silence or confusion which is non-verbal communication is to complement the process of verbal interaction that occurs in the classroom. Teacher talk is categorized further as teacher's question or teacher's statement. The same goes for categorization of student talk. Overall, verbal interaction is based on teacher's talk, student's talk and silence or confusion.

In any lesson, teacher plays an important role in shaping the direction of the lesson. The manner of a teacher teaches is their choice of teaching behaviour, in other word their teaching style (Kellough and Kellough, 2003). Maghsood and Maryam (2011) defined teaching style as teacher's perception on teaching and learning and the behaviour they tend to display. It is widely known that teaching style is considered as one of effectiveness enhancing factors of classroom practice (Opdenakker and Van Damme, 2006). Teaching styles play an important role in building and facilitate teaching and learning process, the way teachers interact with students and manage the classroom (Uzuntiryaki, 2007). Hence, how chemistry teachers in this study interact, manage and play their role in chemistry lesson?

Eggleston, Galton and Jones (1975) found that there are three teaching styles shown by the science teachers in their study which are problem solver, giving information and inquirer. The characteristics of teachers with problem solver teaching styles are they challenge students with questions. Teachers make statements that move towards problem solving activity. For the giving information teaching styles, these teachers concentrate on delivering facts in statement form and instructions to students (Eggleston, Galton and Jones, 1976). A characteristic of teachers in this teaching style is less usage of teacher's question. Teacher's questions are merely that requires cognitive-memory thinking, such as facts that students memorise. Meanwhile, the third teaching style, which is *inquirer*, allows students to be active and communicating in the class (Eggleston, Galton dan Jones, 1976).

Previous researches showed that most of the teaching styles are teacher dominated or teacher-centred (Lunetta et al., 2007; Der Valk and Der Jong, 2009; Tay, 2010). This normally occurs in conventional or described as traditional lesson. In Malaysian school system, time allocated for elective science subjects such as Chemistry is four periods per week which is equivalent to 160 minutes (Ministry of Education, 1990). Curriculum Development Centre in Malaysia has suggested teaching approaches that could be implemented in teaching chemistry at secondary school level. One of the teaching approaches suggested was inquiry teaching (Curriculum Development Centre, 2001, 2005, 2012). As inquiry teaching involves active student participation in the teaching and learning process, we should expect a different approach, i.e. mixed approach; which is combination of teacher and student-centred, or maybe fully student-centred. Hence, what are the teaching styles among chemistry teachers apply inquiry approach?

ISSN: 2278-4012, Volume:2, Issue:4, OCTOBER 2013

In Malaysian context, Ng and Siow (2003) reported that there were four types of teaching styles found in their research on one of smart schools. The teaching styles are teacher talk, teacher directed, teacher directed-informer type, and giving information. Teachers who exhibit teacher talk teaching style tend to make more statement than asking questions. Questions asked were mainly on facts that students were asked to memorised, observed, and application of science principles and interpretation of data. Statements made were mainly facts. There was also limited student activity. Overall, these teachers dominate the lesson by giving lectures, asking questions and demonstrate experiments to students. Next, teacher directed teaching style showed equilibrium between teacher's talk and students' activity. Teachers plan hands-on activity for students. Nevertheless, they tend to make statements, which is transmitting facts and principles to students and asking questions throughout the lesson. Questions were mainly on facts that students were asked to memorised, observed, and application of science principles. Thirdly, teachers in *teacher directed-informer* teaching style apply teacher-centred approach. Teachers make more statements than questions. Statements were mainly of procedure of the experiment and related to classroom management. They gave a very precise instruction before they allow students to carry out experiment. During laboratory lesson also, they will repeat the instruction. Furthermore, they make conclusion for the laboratory work done. Meanwhile, teachers in giving information style, focus on giving information to students and demonstration to students. These teaching styles were found among science teachers in one of the smart schools, who applied mixed teaching approaches. In addition, Nurfaradilla et al. (2010) reported that science teaching in Malaysia is still applying traditional approach which emphasizes on rote learning.

Based on the previous research mentioned above, there are two major teaching styles, which are either teacher-centred or student-centred teaching style. Cadima, Leal and Barahinal (2010) claimed that there are limited researches on the processes that occurs in classroom. Meanwhile, Kumpulainen and Wray (2002) suggested enlarging the field of verbal interaction. This is due to educational process involves interaction (Kelly, 2007).

Part of process of interaction in the classroom involves questioning. Normally, teachers have the privilege and authority to ask questions. Teacher asks questions for many reasons, such as to check students' understanding, to get information from the students and to trigger students' thinking. Hence, type of questions asked play an important role in teaching and learning process. Blosser (1991) categorized questions into two main categories, which are open and closed-ended questions. Open questions involve evaluation or divergent thinking, whereas closed-ended questions involve convergent or cognitive-memory thinking. Open questions are categorized as high order thinking questions, while the closed-ended questions are low-order thinking (Blosser, 1991). Previous research revealed has yet to investigate the characteristics of teaching styles in terms of types of teachers' question(s) and students' question(s). Types of questions asked determined the quality of classroom interaction occurred in classroom. Hence, there is a need to

ISSN: 2278-4012, Volume:2, Issue:4, OCTOBER 2013

study teaching styles and characteristics of teaching styles in terms of type of questions in chemistry lessons via verbal interaction.

Purpose of the Study

1. To investigate teaching styles among chemistry teachers in laboratory and theory lessons.
2. To determine characteristics of teaching styles among chemistry teachers in laboratory and theory lessons.
3. To propose suitable teaching style based on the findings in inquiry-based chemistry lesson.

Methodology

A mixed method study was applied in this study. Twenty three secondary chemistry school teachers (R01-R23) in Kuala Lumpur, Malaysia were involved in this study. Methods of collecting data were by observation using an observation instrument. This observation instrument was adapted and modified based on previous classroom observation instruments developed by Flanders (1970); Eggleston, Galton and Jones (1976); Mohamed Najib (1997); Brandon et al. (2008). This instrument also incorporates all science process skills required in the chemistry curriculum as suggested by Curriculum Development Centre (2001, 2005). This observation instrument, Observation Instrument in Inquiry Teaching through Verbal Interaction (OIITVI) comprises of five main categories, which are teacher's question, teacher's statement, student's question, student's statement and silence or confusion. Observation was done on three second interval as this could ensure a thorough and detail observation as suggested by Flanders (1970); Mohamed Najib (1997). Each teacher was observed four times. Two observations were made in laboratory and theory classes. These 92 observations were audio recorded and video recorded after consent from the respondents were obtained. The recorded lessons were then transcribed verbatim.

In order to find the sequence of teaching, a total of 23 matrixes were tabulated using Statistical Package for Social Science (SPSS) PASW 18.0. A multivariate data technique, named cluster analysis was used to determine teaching styles of chemistry teachers. More specifically, hierarchical cluster analysis was used in the analysis. This type of clustering was used based on suggestion guideline by Mooi and Sarstedt (2011) due to unknown of the number of cluster and object less than 500. Based on these matrixes, four sequences with highest mean were selected as cluster variate. This analysis produce a two dimensional figure which is known as dendogram (Mooi and Sarstedt, 2011). Before using cluster analysis, four sequences with highest percentage were identified to be used in the analysis (see Table 1 and Table 2).

ISSN: 2278-4012, Volume:2, Issue:4, OCTOBER 2013

Table 1: Four Variables With Highest Percentage in Laboratory Lesson

Variable	Description	Percentage (%)
49-49	Group activities followed by group activities	27.25
20-20	Teacher giving explanation related to content followed by teacher giving explanation related to content	7.65
39-39	Teacher giving instruction followed by teacher giving instruction	5.94
32-32	Teacher's statement related to science process skills (experimenting) followed by teacher's statement related to science process skills (experimenting)	4.73

Table 2: Four Variables With Highest Percentage in Theory Lesson

Variable	Description	Percentage (%)
20-20	Teacher giving explanation related to content followed by teacher giving explanation related to content	22.65
46-46	Silence with teacher or student activity followed by silence with teacher or student activity	8.82
39-39	Teacher giving instruction followed by teacher giving instruction	4.48
49-49	Group activities followed by group activities	3.88

Only four variables were chosen as cluster variate due to suggestion by Mooi and Sarstedt (2011) which states that relationship between number of object and number of variables used in the analysis is 2^m, where *m* is the number of variable. Hence, if four variables were chosen in this analysis, the minimum respondent needed is 16 people. The number of respondents involved in this study is 23, which exceeds the minimum requirement number of respondents needed for the cluster analysis.

Cluster analysis using furthest neighbour method (complete linkage) was chosen as the main purpose of the study is to find a pattern. This method was suggested by Hair et al. (2010). The output of this analysis will be discussed in results and discussion section. In order to further understand the reason of the teacher's behaviour, semi-structure interviews were carried out. These interviews were audio recorded and transcribed verbatim.

Findings and Discussion

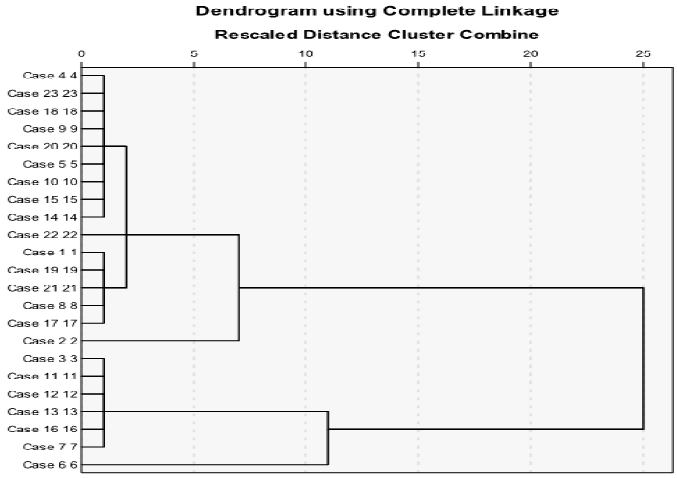
The first part of this section will discuss teaching styles of chemistry teachers in laboratory lessons. Next, is teaching styles in theory chemistry lessons and followed by characteristics of teaching styles in laboratory and theory chemistry lesson.

Teaching Styles of Malaysian Teachers in Laboratory Lessons

Results showed that there are three main clusters exist (see Figure 1).

ISSN: 2278-4012, Volume:2, Issue:4, OCTOBER 2013

Figure 1: Dendogram Using Complete Linkage



The first cluster consists of 16 respondents (69.57%), second cluster, six respondents (26.09%) and the third cluster consists of only one respondent (4.35%) (see Table 3). Based on Table 3, respondents in first cluster emphasise on group activity and teacher giving instruction. Meanwhile, respondents in second cluster, emphasise on group activity and teacher giving explanation regarding to content. The third cluster which is represented by only one respondent showed that this cluster emphasises on giving explanation regarding to content. These findings showed similarities with previous researches finding, which are teachers in cluster one exhibit teacher directed-informer teaching style, teachers in cluster two exhibit teacher directed teaching style and the teacher in cluster three display teacher talk teaching style.

Table 3: Cluster, member of cluster, sequence, mean and emphasis in laboratory lesson

Cluster	Member	Sequence	Mean (%)	Emphasis
1 (16, 69.57%)	R01, R02, R04, R05, R08, R09, R10, R14, R15, R17, R18, R19, R20, R21, R22, R23	49-49	30.45	Group activity and teacher giving instruction
		20-20	3.57	
		39-39	6.14	
		32-32	4.82	
2 (6, 26.09%)	R03, R07, R11, R12, R13, R16	49-49	21.64	Group activity and teacher giving explanation regarding to content
		20-20	15.33	
		39-39	5.59	
		32-32	4.28	
3 (1, 4.35%)	R06	49-49	9.62	Giving explanation regarding to content
		20-20	26.7	
		39-39	4.91	
		32-32	6.01	

Overall result showed that during chemistry laboratory lessons, teachers focused more on group activities, giving instructions and giving explanations regarding to content to students. One of the reasons teachers emphasised on these activities were to ensure the students know how to

ISSN: 2278-4012, Volume:2, Issue:4, OCTOBER 2013

carry out the experiment. It also depends on the type of class. Example of transcripts excerpts are shown below:

Researcher : *During laboratory lesson, you tend to giving explanation and instruction to students. Why?*

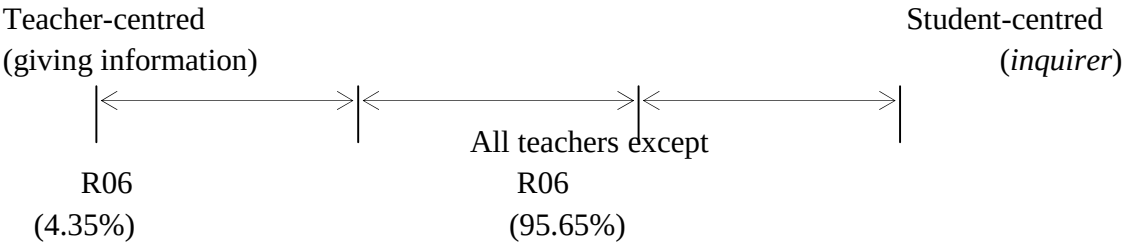
Respondent 23: *When I explained, they will know how to carry out the experiment. If I don't explain, I just let them do on their own…. I am not sure whether they can do it or not. If good students, they will read and carry out the experiment.*

Respondent 6: *So that they will carry out the experiment according to the procedure.*

Teachers' focus was on group activities during chemistry laboratory lesson. This showed a more student-centred approach as required in inquiry chemistry classroom. Video recording showed that students were seen discussing when they carried out experiment in groups. This discussion and hands-on activities are vital as it supports the characteristics of inquiry teaching (National Research Council, 2000). Furthermore, inquiry teaching enhance the mastery of scientific concept through application of science process skills during investigation process (Martin et al. 2009; Ciancilo, Bory and Atwell, 2006; Hammerman, 2006).

In laboratory lessons, most of the teachers were focusing on group activity and teacher giving explanation or instruction. Therefore, most of these teachers were placed in the middle continuum between teacher-centred and student-centred (see Figure 2). This showed that most teachers showed a balance in teaching chemistry, with group activity under teacher's instruction or explanation.

Figure 2: Summary of Teaching Styles in Laboratory Lesson



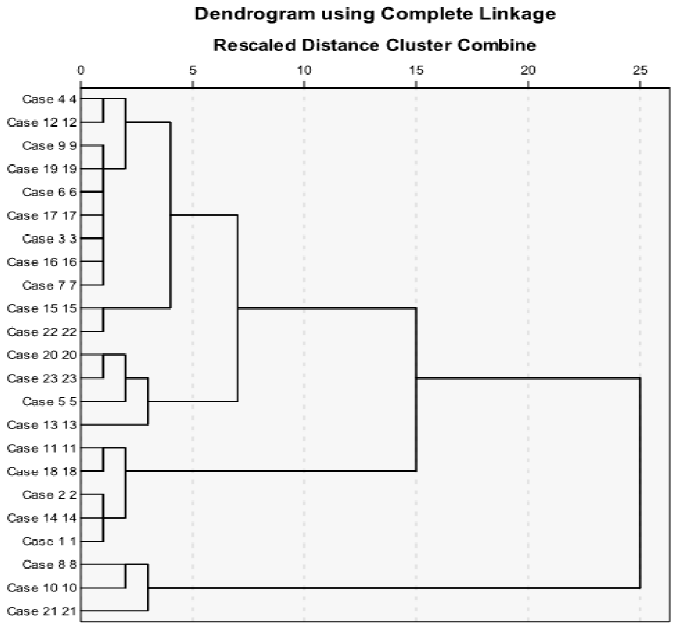
Video recording and researcher's memo showed that discussion in group activities were mainly of students talking about procedure, managerial purposes and very little time allocated for comparing their data or observation with other groups. Furthermore, based on categorization of laboratory instruction style, this teaching style is categorized as expository style as teacher define the topics to be investigated and this is categorized as deductive approach, whereas inquiry are based on inductive approach (Domin, 1999).

Teaching Styles in Theory Chemistry Lessons

Same analysis was applied to determine teaching styles in theory chemistry lessons. Cluster analysis done using furthest neighbour method showed there are three clusters based on the dendogram (see Figure 3).

ISSN: 2278-4012, Volume:2, Issue:4, OCTOBER 2013

Figure 3. Dendogram Using Complete Linkage



The first cluster consists of five respondents (21.74%), emphasised on silence with teacher or student activity. Meanwhile, 15 respondents (65.22%) in cluster two shows that the respondents mainly giving explanation. Explanations made were mainly on the chemistry content. Only three respondents (13.04%) in cluster three emphasised in group activities (see Table 4).

Table 4: Cluster, member of cluster, sequence, mean and emphasis in theory lesson

Cluster	**Member**	**Sequence**	**Mean (%)**	**Emphasis**
1 (5, 21.74%)	R01, R02, R11, R14, R18	20-20	20.71	Silence with teacher or student activity
		46-46	23.42	
		39-39	4.20	
		49-49	1.77	
2 (15, 65.22%)	R03, R04, R05, R06, R07, R09, R12, R13, R15, R16, R17, R19, R20, R22, R23	20-20	25.67	Teacher giving explanation
		46-46	5.04	
		39-39	4.55	
		49-49	2.71	
3 (3, 13.04%)	R08, R10, R21	20-20	10.76	Group activities
		46-46	3.41	
		39-39	4.57	
		49-49	13.29	

ISSN: 2278-4012, Volume:2, Issue:4, OCTOBER 2013

This shows that in theory lessons, teacher's explanation was the main verbal interaction as represented by second cluster (65.22%). Example of transcript of the lesson is shown below:

Respondent 02: Open your module. We will continue. Ok. Properties of oxide, meaning sodium oxide, magnesium oxide, aluminium oxide. Elements are classified into metals or non metals based on their acidic or basic properties of their oxide. Metal form oxide with basic property. Some elements formed oxide with both basic and acidic property. Basic is base. Acidic property is acid ok… basic means base. Base is alkali. This one is called amphotheric oxide. ok. Ah… ok…ok… metal will form basic oxide. Basic oxide means it will form alkali. (21:31) Some metal can form oxide with both acidic and basic property.

In cluster 1, main activities that contributed to silence with teacher or student activity were students were asked to answer questions in chemistry module, hands-on book or worksheets that have been prepared by the teachers. Most of the lessons were on discussing questions in the module and textbook. Example of teacher's lesson transcript which emphasised on module is shown below:

Respondent 02 : Ok… (29:54) Before we move to next one… before transition ah…open your module.. I want you to do… turn to page sixty three. There are five… isn't it?
Student 1 : Yes
Respondent 02 : You do, question three, four five. Do it now. Don't refer to the textbook. Do it yourself.

To understand the reason underpinning these activities, semi-structured interviews were conducted. The main reasons stated by the respondents were due to syllabus and time factor. They want to complete the syllabus as soon as possible and as the questions in the module were prepared by excellent teachers whom were involved in the setting of standard public examination papers. This syndrome of covering syllabus showed that these teachers are still adopting teacher-centred approach which is the traditional way of teaching. As a consequence, students just memorise what they learned in class (Trowbridge and Bybee, 1996).

Example of segment of the transcript of the interview was shown below:

Researcher : What is the purpose of using chemistry module during lesson?
Respondent 14: Fast. Able to cover syllabus faster.
Researcher : How about text book?
Respondent 14: Text book is too simple… This module…was prepared by excellent teacher involved in setting questions for standard examination. The questions are similar as in the module.

ISSN: 2278-4012, Volume:2, Issue:4, OCTOBER 2013

In theory lessons, most teachers showed teacher-centred pattern by focusing more on giving information, followed by teaching based on resource (referring to chemistry module, hands-on book, prepared worksheet). Only 13.04% respondents focus on group activity (see Figure 4).

Figure 4: Summary of Teaching Styles in Theory Lesson

Teacher-centred (giving information)	Teaching based on Resource	Student centred (*inquirer*)
R03, R04, R05, R06, R07, R09, R12, R13, R15, R16, R17, R19, R20, R22, R23 (65.22%)	R01, R02, R11, R14, R18 (21.74%)	R08, R10, R21 (13.04%)

R: Respondent

The findings from this study are supported by previous researchers done by Eggleston, Galton and Jones, 1976; Ng and Siow, 2003) which showed that teaching styles found were giving information and inquirer. The mean percentage of teacher's statement (50.09%) is higher than mean percentage of teacher's question (18.13%). This shows that teachers in giving information continuum made more statements than asking questions as stated by Eggleston, Galton and Jones (1976).

Characteristics of Teaching Styles of Chemistry Teachers During Laboratory Lessons

In the previous discussion, the teaching styles of chemistry teachers were examined. Next, the characteristics of teaching styles in practical and laboratory lessons will be discussed. Discussions on characteristic of teaching styles are based on type of teacher's questions and students' questions. Most questions asked by respondents in cluster 1 are closed-ended questions (2243 questions, 54.04%) followed by managerial questions (1695 questions, 40.83%). The closed-ended questions were of cognitive-memory thinking questions (33.05%).

In terms of students' questions, students' questions were more on managerial questions (855 questions, 54.60%) followed by closed-ended questions which requires cognitive-memory thinking (673 questions, 41.83%). Similar patterns were found for cluster 2 and 3 respondents. However, the students' questions in cluster 2 were more on closed-ended questions which requires cognitive-memory thinking (266 questions, 53.85%), followed by managerial questions

ISSN: 2278-4012, Volume:2, Issue:4, OCTOBER 2013

(217 questions, 43.93%). Students' questions in cluster three show similar pattern as students' questions in cluster 1.

Characteristics Of Teaching Styles Of Chemistry Teachers During Theory Lessons

Type of teacher's questions in cluster 1 were of closed-ended questions which requires cognitive-memory thinking (944 questions, 38.86%), followed by managerial questions (760 questions, 31.29%). Respondents in cluster 2 frequently asked closed-ended questions which require cognitive-memory (2330 questions, 34.00%) and closed-ended questions which require convergent thinking (2115 questions, 30.87%). Respondents in cluster 3 showed reverse pattern in teacher's questions with respondents in cluster 2. High percentage of teacher's questions were closed-ended questions which require convergent thinking (367 questions, 34.79%), followed by closed-ended questions which require cognitive-memory (342 questions, 32.42%). Students' questions in cluster 1, 2, and 3 show similar pattern, with emphasis on closed-ended questions which requires cognitive-memory thinking followed by managerial questions.

Frequent usage of low order thinking questions inhibit the inquiry process. Teacher's questions should be of high order thinking questions to inculcate thinking habits among students. This type of question enables teachers to explore student's ideas and involve students to elaborate on ideas given.

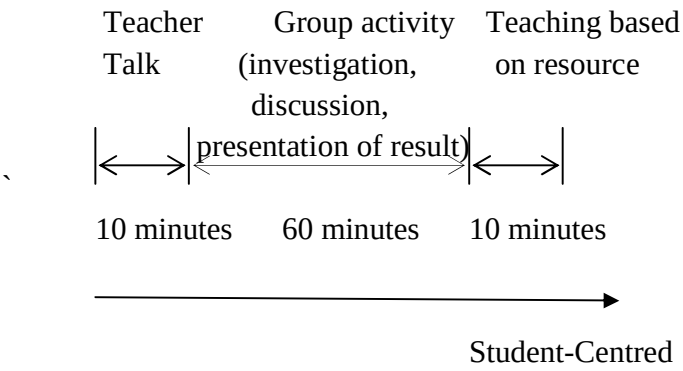
Conclusion and Implication to Chemistry Teaching

There are differences between teaching styles of chemistry teachers during laboratory and theory lessons. In laboratory lesson, they focused more on group activities after they gave instruction or explanation. Meanwhile, in theory lesson, these teachers explained and instructed students to resources such as module, worksheet or hands-on book. Nevertheless, most questions asked by teachers were of closed-ended question. Teacher-centred teaching style is still prevalent now although teachers attended in-house courses and trainings on teaching and learning strategies.

Based on the findings, authors suggest time allocation for activities in chemistry classroom, either in theory or laboratory lesson. There should be a gradual shift from teacher-centred to more student-centred teaching style, which focuses on group activities and resource based (see Figure 5). More opportunity and freedom should be given for students to discuss, plan experiments, gather data, analyze and interpret data and communicate. Both students and teachers share responsibility in the teaching and learning process. More time should be made for group activities; such as investigation, discussion and presentation compared to teacher talk.

ISSN: 2278-4012, Volume:2, Issue:4, OCTOBER 2013

Figure 5: Proposed Teaching Styles in Chemistry Lesson



In conclusion, it is all depends on the teachers themselves to have the right attitude and interest in upgrading their teaching skills to create a student-centred classroom.

References

Blosser, P.E. (1991). *How to Ask The Right Questions*. National Science Teachers Education.

Brandon, P.R., Taum, A.K.H., Young, D.B., & Potenger III, F.M. (2008). The Development and Validation of The Inquiry Science Observation Coding Sheet. *Evaluation and Program Planning*, *31*(3), 247-258.

Brown, G. (1975). *Microteaching*. London: Methuen.

Chamberlain, A., & Llamzon, T. (Eds.) (1982). *Studies in Classroom Interaction*.Singapore: SEAMEO Regional Language Centre.

Cadima, J., Leal, T., & Barahinal, M. (2010). The Quality of Teacher-Student Interactions: Associations With First Graders' Academic And Behavioural Outcomes. *Journal of School Psychology*, *48*, 457-482.

Ciancilo, J., Bory, L., & Atwell, J. (2006). Evaluating the Use of Inquiry-Based Activities: Do Student and Teacher Behaviours Really Change? *Journal of College Science Teaching*, *36* (3), 50-55.

Curriculum Development Centre [Pusat Perkembangan Kurikulum] (2001). *Nota Penerangan Pusat Latihan Kursus Orientasi Sains KBSM PuLKOS Inkuiri-penemuan dalam Pengajaran dan Pembelajaran Sains* [Explanation Note of Science Orientation Course Centre KBSM Inquiry Discovery in Teaching and Learning Science]. Kuala Lumpur, Malaysia: Ministry of Education.

Curriculum Development Centre (2005). *Curriculum Specification Chemistry Form Four*. Putrajaya: Ministry of Education, Malaysia.

Der Valk, T.V. & De Jong, O. (2009). Scaffolding Science Teachers in Open-Inquiry Teaching. *International Journal of Science Education*, *31* (6), 829-850.

Eggleston, J.F., Galton, M. & Jones, M. (1975). *A Science Teaching Observation Schedule*. London: Macmillan Education.

ISSN: 2278-4012, Volume:2, Issue:4, OCTOBER 2013

Eggleston, J.F., Galton, M., & Jones, M. (1976). *Processes and Products of Science Teaching*. London: Macmillan Education.

Flanders, N.A. (1970). *Analyzing Teaching Behaviour*. USA: Addison-Wesley Publishing Company.

Hair, J.F., Black, W.C., Babin, B.J., & Anderson, R.E. (2010). Multivariate Data Analysis: A Global Perspective. Upper Saddle River, New Jersey: Pearson Education, Inc.

Hammerman, E. (2006). *Eight Essentials of Inquiry-Based Science, K-8*. Thousand Oaks, California: Corwin Press.

Kellough, R.D., & Kellough, N.G. (2003). *Secondary School Teaching: A Guide to Methods and Resources* (2nd edition). New Jersey: Pearson Education, Inc.

Kelly, G.J. (2007). Discourse in Science Classrooms. In Abell, S.K. & Lederman, F.C. (eds). *Handbook of Research on Science Education* (pp. 443-469). Mahwah, NJ: Lawrence Erlbaum.

Kumpulainen, K., & Wray, D. (Eds.) (2002). *Classroom Interaction and Social Learning: From Theory to Practice*. Routledge Falmer: London.

Lunetta, V.N., Hofstein, A., & Clough, M.P. (2007). Learning and Teaching in the School Science Laboratory: An Analysis of Research, Theory and Practice. In Abell, S.K. & Lederman, F.C. (eds). *Handbook of Research on Science Education* (pp. 393-441). Mahwah, NJ: Lawrence Erlbaum.

Maghsood, A.K., & Maryam, F. (2011). The effect of teacher's teaching style on students' adjustment. *Procedia Social and Behavioral Sciences, 15*, 1391–1394.

Martin, R., Sexton, C., Franklin, T., Gerlovich, J., & McElroy, D. (2009). *Teaching Science for All Children: An Inquiry Approach*. (5th Edition). Boston: Pearson.

Ministry of Education (1990). *Surat Pekeliling Ikhtisas Bil. 8/1990: Sukatan Pelajaran dan Peruntukan Masa Untuk Mata-Mata Pelajaran Program Kurikulum Bersepadu Sekolah Menengah (KBSM) bagi Sekolah Menengah Atas Mulai Tahun 1992*. [Circulation Letter Number 8/1990: Curriculum Syllabus and Time Allocation for Subjects under Integrated Secondary School Programme for Secondary Schools Beginning 1992]. 15 December 1990. Kuala Lumpur.

Mohamed Najib Abdul Ghafar (1997). *Access and Success in Higher Education*. Johor: Universiti Teknologi Malaysia.

Mooi, E., & Sarstedt, M. (2011). *A concise guide to market research: The process, data, and methods using IBM SPSS statistics*. Berlin: Springer.

Myhill, D. and Dunkin, F. (2005). Questioning Learning. *Language and Education*. *19*(5), 415-427.

National Research Council (2000). *Inquiry and the National Science Education Standards*. Washington, DC: National Academic Press.

Ng, S.B., & Siow, H.L. (2003). Creating a thoughtful classroom: Teaching profile of science teachers in Malaysian secondary school. *Paper presented in International Conference of Science and Mathematics Education*. 14- 16 October. Kuala Lumpur.

ISSN: 2278-4012, Volume:2, Issue:4, OCTOBER 2013

Nurfaradilla Mohamad Nasri, Zakiah Mohd Yusof, Shanti a/p Ramasamy, & Lilia Halim (2010). Uncovering Problems Faced by Science Teacher. *Procedia Social and Behavioural Sciences*, *9*, 670-673.

Opdenakker, M.C., & Van Damme, J. (2006). Teacher Characteristics and Teaching Styles as Effectiveness Enhancing Factors of Classroom Practice. *Teaching and Teacher Education: An International Journal of Research and Studies, 22*(1), 1-21.

Rohizani, Y., Shahabuddin, H., & Mohd Zohir, A. (2003). *Pedagogi, Strategi dan Teknik Mengajar Dengan Berkesan* [Pedagogy, Strategy and Technique of Effective Teaching]. Pahang: PTS Publications and Distributor Sdn. Bhd.

Tay, C. S. (2010). *Constructivist Practice of Primary Science Teachers Through Verbal Interaction*. (Unpublished Doctoral Thesis). Skudai, Johor: University Technology Malaysia.

Trowbridge, L.W., & Bybee, R.W. (1996). *Teaching Secondary School Science: Strategies for Developing Scientific Literacy* (6th edition). Englewood Cliffs, New Jersey: Prentice-Hall, Inc.

Uzuntiryaki, E., & Boz, Y. (2007). Turkish Pre-Service Teachers' Beliefs About the Importance of Teaching Chemistry. *Australian Journal of Teacher Education*, *32*(4), 1-16.