Types of Wait Time during Verbal Questioning in the Science Classroom

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Abstract

Wait time is one of the elements recognized as being able to enhance thinking skills in the verbal questioning process. However, there is a need to focus on and evaluate how it is practiced in the teaching process. Results showed two types of wait time, which the authors named, wait time I and II. This paper discusses part of a larger study conducted to expose the wait time practices of three chemistry teachers' verbal questioning process during the teaching of electrochemistry in the classroom. Data was collected through observation and in-depth interviews. Result showed that wait time type I occurred in two phases. Phase I occurred between teachers' questions and teachers' reactions, and Phase II occurred between teachers' actions and students' responses. The time ranges for both phases were quite long. Wait time II was very short, since teachers would immediately give feedback to the tudents. It was found that teachers were not keen on allocating wait time due to the lack of cooperation from students, and the teachers usually ended up simply giving the answers to the questions.

Keywords: teacher's question, student's question, verbal questioning, wait time, teaching, classroom

1. Introduction

It is important to allocate wait time during verbal questioning in the classroom (Fries-Gaither 2008). Teachers have to prepare proper questions before class in order to get good answers from students during class. In the process of questioning, teachers have to listen to the students' answers and their questions carefully to get the meaning of the knowledge discussed. It is important to help them in their difficult learning sessions and to help them obtain meaningful learning (Bysen & Bysen, 2010). Wait time is one of the important elements in the questioning process to increase their thinking.

The wait time provides the students with the opportunity to reflect upon the statement made by the teacher and is essential to student thinking (Albergaria-Almeida, 2010). The length and the quality of student answers depended on length of time allotted by the teacher after asking the questions. It also gives the teacher the time to reflect on the statement she or he has made and to think of what should be said next. Tobin (1987) found that an increase of 1 to 3 seconds in wait time has a number of effects. Among others things, it decreases teachertalk, reduces low level verbal questions, increases high level verbal questions and increases further verbal questioning.

In a true teaching context, however, teachers often do not realize the importance of wait time, and the normal wait time range of 0.98 to 1.5 seconds usually allocated is rather short (Zainuddin, 2005). Some teachers even regard "wait time" as a hindrance to their teaching plan, even if they are aware that wait time could enhance students' thinking skills (Baki, 2001). Because of the importance of wait time in the teaching process, this study aims to explore the wait time pattern among five teachers in the teaching of electrochemistry.

2. Wait Time during Verbal Questioning

Wait time range can be increased through awareness and training (Subramaniam, 2005). This was proven by Davivongse (1984) through an experiment involving science teachers. Results showed that the science teachers in the experimental group were able to increase wait time by an average of 3 seconds. This increase in wait time range

increased the number of high-level cognitive verbal questions. An experiment conducted by Gooding and Swift (1982) found that wait time was able to yield better results in terms of interaction and active student participation.

A study by Tobin (1980) showed that an allocation of more than three seconds for wait time reduced the number of teacher talk per unit time, reduced the number of times teachers interjected in students' discussions, increased students' responses, and also increased the number of questions asked by students. Another study conducted by Tobin (1986) showed that when wait time is increased, the number of teachers' verbal questions which require students to make mathematical applications increased while the number of verbal questions relating to comprehension decreased.For arts stream students, increasing wait time allows the teacher to ask comprehension verbal questions, compared to a shorter wait time when the teacher is more likely to ask verbal questions related to recall. Further studies have showed that increasing wait time reduces the number of students giving an incorrect answer and questions, increases conclusions based on evidence, and increases the variety of students' verbal behavior and the length of student responses (Bysen & Bysen, 2010). An increase in wait time also affects teacher's behavior during teaching in terms of teacher talk (decrease), sentence repetition (decrease), changing verbal questions (decrease), asking verbal questions (decrease), high level cognitive verbal questions (increase), low level cognitive questions (decrease), further verbal questions (increase), mimicking (decrease) and teacher's anxiety (decrease). These studies showed the need for teachers to have knowledge and awareness of wait time so that they would be able to implement wait time effectively and achieve better result.

In the process of questioning in the classroom, Tobin (1987) and Albergaria-Almeida (2010) identifies wait time I and wait time II based on the definition given by Rowe in 1986. Wait time I refers to the time range after the teacher asks a question up to the time of the student's response, while wait time II refers to the time between the student's response and the teacher's feedback.

3. Methods

The bigger study involved five chemistry teachers where each teacher was observed five times and each of the teachers was interviewed four or five times. However in this paper data was collected from only three teachers which will be discussed as the data collected was enormous.

The three selected teachers were Nora, Salina and Zai. Data was collected through observations and in-depth interviews using audio and video recording. A voice recording device (MP3) hanging from the teachers' neck was used to record teacher talk during teaching. At the same time, the researcher conducted non-participatory observation from the back of the classroom while video recording.

All audio recording were transcribed verbatim. In this study, the teachers' verbatim transcripts were unique in that they consisted of (i) the teachers' and students' dialogue, (ii) wait time range, and (iii) the researcher's observation notes made during the teaching and learning process. Wait time was recorded as soon as a teacher finished asking a question; at the beginning of a teacher's action before and after a student's response; and at the early stage of a teacher's feedback. The wait time was analyzed and an interview was conducted to explore each teacher's practices with regards to wait time during the questioning process. In total for the longer study, almost five to six months were spent in collecting the data.

4. Results and Discussion

The questioning process begins with the question asked by the teacher (Q), followed by student's response (R), teacher's feedback (F), and follow-up question by the teacher. This sequence of the questioning process is also studied by using IRF (Initiation-Response-Follow up question) by Chin (2006) and it can be seen as a recycling process (Yang, 2006). There is a wait time between the teacher's question, student's response and teacher's feedback. The wait time in the questioning process in this study also occurs in a number of situations in the teaching of electrochemistry. This study found that between the teachers asking a question up to the time of the students' response (wait time I), there were two phases of time separated by the teacher's action (A). Table 1 is the dialogue from Nora's teaching episode on the topic of "characteristics of ionic compounds" to show the phases of time.

Table 1. Wait time range in teacher Nora's electrochemistry teaching episode

Teacher/ student	Dialogue	Waiting time	Researcher's Comment
Nora	Prior to this, we have learned about *ionic compounds* and *covalent compounds*, Okay!, *So*, *can you remember the properties of ionic compounds?* (1.45)	Q-A (9 sec)	Students did not respond to the question, and Nora repeated the question (wait time range = 9 seconds)
Student	(no response)		
Nora	(1.54) [MP3:1.54-1.45=0.09] Okay, *Can you remember the properties of ionic compounds?* (2.00)	A-A (12 sec)	Nora repeated the question after failing to get a response from the students.The teacher finally called one of the student's names after waiting for 12 seconds.
Student	(no response)		
Nora	(2.12) [MP3:2.12-2.00=0.12]. Okay, Fakih! *Can you remember the properties of ionic compounds?* (2.19)We learned this in the previous lesson …	A-R (18 sec)	The time range allocated for students to answer after calling the student's name and repeating the question was 18 seconds.
Fakih	(2.37) [MP3: 2.37-2.19=0.18](stands and answer) *dissolves in water* (2.38)		
Nora	(2.38) [MP3:2.38-2.38=0)] Ha…one of the ionic compounds, *dissolve in water*, correct!, please sit down. What are the other properties?	R-F (0 sec)	The teacher accepted the student's answer and repeated the student's answer without any wait time.

Nora Q: teacher's question, A: teacher's action, R: student's response, F: teacher's feedback

This teaching dialogue by Nora relates to the "characteristics of ionic compounds". These are low level questions since they require the students to recall the "characteristics of ionic compound" taught in the previous lesson. The students failed to respond after the question was first asked by the teacher, even though the teacher waited for nine seconds for the students to respond. Therefore, Nora repeated the question and gave the students another 12 seconds to respond. Both these wait times are within the range of the teacher's question and the student's response. Hence, this study found that wait time type I occurred in two phases. Phase I occurred between the teacher's questions (Q) and teacher's action (A) range, Phase II occurred in the teacher's action (A) and student's response (R) range. After failing to get a response from the students, the teacher called on one student (Fakih) to answer the question. Heinze and Erhard (2006) also determined two kinds of wait time between the teacher asking question and the students starting to respond based on mathematics class.

This teaching episode showed that wait time type II (between student's response and teacher's feedback) did not occur since Nora gave immediate feedback to the answer given by Fakih. The wait time pattern in the above example in Nora's class is shown in Figure 1.

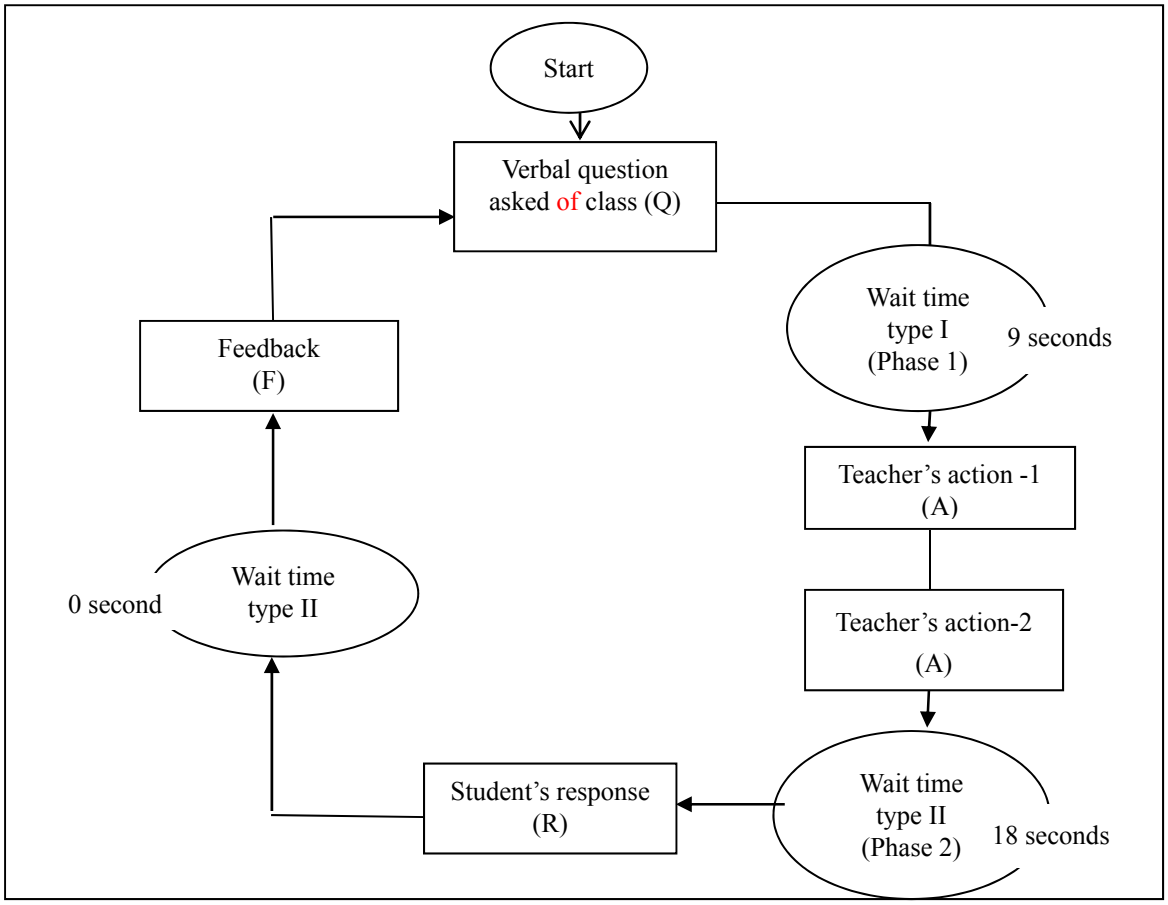

Figure 1. Wait time pattern in Nora's teaching episode

According to Nora, the relatively long wait time is for a difficult question, and a shorter wait time is allocated for easy questions.She stated that, *"Sometimes it depends on the question.The wait time is shorter for easy question.And I might allow a longer time for the students to respond to a difficult question ..." [N,TB4(151008)/297-299]*. Heinze and Erhard (2006) also found that wait time depended on certain properties of the teacher's questions. However, it can be seen from Nora's teaching episode that she allowed a long wait time for a low-level recall question.The above teaching episode showed the total wait time type I is ~53 seconds (2.38-1.45 = 0.53). This is because Nora was unable to get a response from the students, and yet she still expected them to answer her question.Since Nora expected her students to respond, she allocated a longer wait time and repeated the question, as the question asked related to the previous lesson.

In this case, it appears that the longer wait time is due to the students' refusal to cooperate and respond. Nora still wants an answer from her students, and she waits for a long time to get that answer. It was stated by her that"During questioning, howsoever we want to wait for their responded, although the students silent, I still want to wait, maybe they are thinking ... so we wait for their answer. If they cannot respond, we need to give some hint for them to answer …" [N,TB1(240608)/49-52]. This study found that Nora had to take action (A) to encourage the students to answer her question. Among the actions taken by Nora were giving a clue, refining the question by lowering its level, elaborating on the question, approaching the students, using a teaching aid to clarify the question, observing the students, giving the students the opportunity to volunteer, and calling upon a particular student. Heinze and Erhard (2006) mention that additional information may be necessary for the students to understand the question. This teacher's action could be a catalyst and provided the stimulus for further student thinking (Martino & Maher, 1999).

This pattern of questions was also shown in Salina's class. Table 2 showed one episode of Salina electrochemistry class on the concept of the difference between molten compound and aqueous solution. This excerpt comes from the observation (Data source: S,4I,P1(070708)/44-71).

Table 2. Wait time range in Salina's electrochemistry teaching episode

Teacher/ student	Dialogue	Waiting time	Researcher's Comment
Salina	Today we are going to learn about electrolysis of a molten compound… Ok, you know that electrolysis involves aqueous solution and molten compound…Ok, what is the difference between molten compounds and aqueous solutions? (11.30)	Q-A (3 sec)	Students did not respond to Salina'squestion. She repeated the question (action). (wait time range = 3 seconds)
Student	(no response)		
Salina	(11.33-11.30=0.03) the difference in term of the content of the two substances (11.39)	A-A (13 sec)	Salina repeated the question after failing to get a response from the students.Salina gave some motivation (action) which ask a volunteer to answer her question. Finally, she called on Multhivanan and repeated the question after waiting for 13 seconds.
Student	(no response)		
Salina	(11.46) Any idea? Do you have any idea? (11.49) Multhivanan, (11.52-11.39=0.13) What is the difference in terms of the content between these two substances?", (11.58).	A-A (18 sec)	Multhivanan did not answer the question until Salina gave some hint about the question. The time range allocated for students to answer after calling the student's name, repeating the question and give some hint was 18 seconds.
Multhivanan	(11.59) (Multhivanan stand up and quite)		
Salina	(12.00) Actually we have copper(II)sulphate…ok, one is copper(II)sulphate solution and the other one is molten copper(II)sulphate,(12.16-11.58=0.18) What is the difference between the two? (12.17).	A-R (1 sec)	Multhivanan answered the question after getting some hints, but the answer was wrong
Multhivanan	(12.18-12.17=0.01) aqueous is solid and molten is liquid (12.30).		
Salina	(12.35-12.30=0.05) Ok, actually, when the substance is aqueous solution, water is added to the substance, when it is molten compound…it is just …the substance without any added substance, water or anything else…Understand?	R-F (5 sec)	Salina accepted Multhivanan response after repeating the question and received the correct answer after 5 seconds.

Note: Q: teacher's question, A: teacher's action, R: student's response, F: teacher's feedback.

In this episode, Salina asked about the difference between a compound and an aqueous solution. Students needed to compare and contrast the two concepts. In this case, Salina did not get a response from students until 13 seconds had passed. Salina did some actions as repeated the question, gave some motivation and called specific names. Her question did not get response from Multhivanan for about 18 seconds until she gave a hint. She mention that the name of the chemical is same (Copper(II)Sulphate) but the difference was the type of state, solution and molten. Here, the students have to know the concepts of molten and solution. Finally, Multhivanan responded that "the aqueous is solid and molten is liquid", which was not correct. Then, Salina responded to her student's answer by

giving the correct answer.

From Salina's perspective, she admitted that wait time is crucial to give the students the opportunity to think. However, Salina felt that the wait time element involved a long period of time in the overall teaching process. According to Salina it is difficult to implement wait time since the allocated 40-minute teaching time is too short and goes by quickly. Since there are so many things that need to be elaborated she usually used the explanatory approach, especially with not so bright students. In comparison to Nora's teaching episode, the flow of questioning in Salina's class was similar except that there was no wait time.

Teacher Zai also, did not allocate a long time when she failed to get a response from students. She would redirect the question to another student whom she felt would be able to respond quickly. Zai's action could be found in the teaching episode shown in Table 3.

Table 3. Wait time range in Zai electrochemistry teaching episode

Teacher/ student	Dialogue	Wait time	Researcher's Comment
Zai	Anybody tell me what are the ions present in this solution? (25.25)	Q-A (2 s)	Zai distributed question to all students, but no response from them until 2 seconds, then she repeated the question.
Students	No response		
Zai	(25.27) Can you tell me the ions present in this solution? (25.31). (25.50) Athirah. Do you understand my question? (25.51)	A-A (19 s)	Zai repeated the question, and then waited until 19 seconds before calling on Athirah. She asked whether Athirah understood the question.
Athirah	Not understand		
Zai	(25.55) Can you please tell me the ion present in this solution? (25.59) Could you tell me what type of ion is in this solution? (26.04)	A-A (8 s)	Zai repeated the questions again but still no response from Athirah. Lastly, Zai gave some motivation. It took 8 seconds.
Athirah	No response		
Zai	(26.07-25.59=0.08) Ok come on, you have learnt during electrolysis …		After motivation, some students gave Na^+ as an answer. Zai guided the students to get the answer one by one and finally validated the students' answer without asking further questions.
Students	(26.13) Na+…Cl-	A-R	
Zai	(26.20) Na+…next? (26.23)…		
Students	Cl^-		
Zai	(26.23) Cl^- …(77) Next		
Student	Oxygen (not clear)		
Zai	(26.27) Remember…aqueous solution my dear		
Students	H^+		
Zai	(26.34) H^+…next		
Student	(26.35) OH^-	R-F 1 s	
Zai	(26.36) OH^-…. Ok, this is the ion in this solution.		Zai agreed with the student answer without asking further about their answer.

This study found that the wait time range is not directly related to the cognitive level of the questions. This is because the teachers have difficulty getting responses from the students. According to Black and Harrison (2001), the implementation of wait time type I often posed a problem for teachers, since they do not know what the students are thinking and how far the students are involved in the thinking process to search for an answer. Information processing involves internal activity that is what goes on in a person's mind and emotions (Morgan & Saxton 2006).Because of this, teachers most often allocate a short period of time (less than one second) after asking a verbal question (Black and Harrison 2001). This does not give the students' ample time to think and put forth their own ideas; instead the students only regurgitate the facts they already know.

A number of researchers have suggested that an effective wait time is between 3-5 seconds (Tobin 1980, 1987; Wragg & Brown 2001). These researchers found that a wait time range exceeding 3 seconds enhanced the quality of the answer given by the students. This longer wait time also increased students' performances because the teacher had ample time to ask the student to elaborate on their answer compared to a short wait time, in which the teacher only repeats the answer given by the student (Tobin, 1986). But this did not happen in this study. The longer wait time has no result for the better response or a higher quality of the answer.

In addition, the answer required might need to go through a few steps of analysis, and therefore a rather long period is needed to provide the answer. For example, one question asked by Salina was, "What was produced at the cathode in the electrolysis of Copper (II) Sulfate?" The answer to this question is a one-word aswer. To determine the answer to this question, students need to do analysis, namely listing the cation and anion by writing on a piece of paper so that they would be able to see it. The students then determine the type of ions moving towards a particular cathode, before identifying the ion to be discharged by referring to the electrochemical series. Therefore, wait time is absolutely crucial, even though the question requires is a very basic one-word answer.But sometimes,the teacher did not give any opportunity to the students to explain theiranswers (Iksan et al., 2013). Hence, the determination of wait time depends not only on the type of question, but also on the process of getting the answer.

This study is also similar to the one conducted by Heinze and Erhard (2006) which showed that there is no obvious relationship between the level of question and wait tme. In addition, teachers did not use wait time as an instrument to enhance the quality of teaching even though this has been proven in a series of empirical studies (Heinze & Erhard 2006). Albergaria-Almeida (2010) also proved that asking higher-level questions could enhance students' thinking and reasoning. Teachers still focus on the process of disseminating information to ensure that the teaching objective is achieved. Other studies found that the allocation of a long wait time does not guarantee a good answer from students, and this made the teachers unsure of implementing wait time. A similar study showed that allocating a longer wait time does not necessarily guarantee an accurate answer (Tincani & Crozier, 2007). This might be because students do not have a good understanding of the concept being discussed.

This study found that allocating a long wait time rarely occurs since it is difficult to get students to participate voluntarily, even after the teacher allocated more than three seconds wait time. As a result, teachers need to take various actions after asking a question to encourage students to respond by changing the question to a low level cognitive question. Therefore, the allocation of a rather long wait time provides the opportunity for interaction and the involvement of more students (Carin, 1993; Gooding & Swift, 1982). Previous studies showed that the implementation of wait time influenced students' responses and involvement. A study by Tobin (1986) showed that teachers need to allocate a longer wait time to encourage the involvement of other students in giving an answer based on the discussion of a few students.

A short time range occurs in the wait time type I with low-level cognitive questions that are asked openly. Students responded immediately and in unison, beyond the teacher's control, without any wait time. This usually happened with a basic concept or a concept that had been repeated several times, so it is engrained in the students' minds. A short wait time encourages the students to merely regurgitate the facts that are already in their minds (Black & Harrison, 2001).

This study also found that the wait time type II did not occur among Nora's and Zai's teaching episodes and only occurred in Salina's teaching episode.This is because Nora and Zai immediately gave brief feedback by repeating the student's answers. Nora and Zai were also inclined to guide the students in giving the answers to easier questions. A quick feedback was given to validate the student's answer by repeating the correct answer. Nora and Zai often asked a question with the intention of guiding the students to give a correct answer if the answer given was incorrect. Consequently, Nora and Zai ignored the answers given by students and this discouraged the students from interacting in class; this is especially so with introverted students. However, these findings contradict those of Martin et al. (2005), which showed that increasing wait time type II could alter the teacher's teaching method, especially in terms of further verbal questioning. Martin et al. (2005) believed that students' responded in a variety of ways when

teachers allocated more than a three-minute wait time. This time is also sufficient for teachers to take into account all responses from the students, evaluate them and formulate a more meaningful question to ask next. This requires planning and thinking on the teacher's part.

This study found that the three teachers (Nora, Salina and Zai) acknowledged the importance of wait time and hoped that the time allocated would be used by students to think and come up with an answer. However, the teachers admitted that the implementation of wait time in their teaching is done unconsciously. Salina mentioned that the teaching time goes by very fast, with many things to do within a very limited amount of time. Salina mentioned that "40 minutes happen very fast, I have not enough time to explain many things to my students …sometimes if the students do not understand this way, I have to choose another way, for example use a picture and give another example. There were noresponses from low-level students, so I just give an explanation to them, they never asked questions or argue. They will accept whatever is given to them. The acceptance means absorbed…"[S, TB4(100409)/294-302]. Zai also did not spend a long time getting responses. She stated that "I don't want to wait for a long time; I immediately pass the question to other student or call on other student…" ZTB2 (051108)/450-451]

Hence, teachers are not aware of the wait time after their questions and do not use the wait time as an instrument in their teaching (Heinze & Erhard, 2006). According to Zainuddin (2005), the teachers admitted to the weakness of wait time since they have never been exposed to the wait time element (Zainuddin 2005).Therefore, teachers need to increase their awareness regarding the importance of wait time so that it can be used to enhance students' thinking skills (Davivongse, 1984; Tobin, 1987).

Although the teachers in this study admitted that the thinking process occurs during wait time, they also felt that the wait time element in the verbal questioning process takes quite a significant amount of time in the teaching process. This occurs when students do not cooperate or voluntarily participate in the verbal questioning process. This is in line with Farrell's (2004) findings, which showed that students preferred to wait until they are called upon to answer the teacher's question, or wait for the teachers to give the answer.

This study also found that teachers allocated a long wait time and that it is difficult to get the students to respond. Hence the teaching is often done utilizing the explanation technique, especially with slow learners, since these students do not like to ask questions during the teaching and learning process in the classroom. Students prefer to not participate and to accept a teacher's explanation without showing whether or not they understand the lesson being taught. In this situation, the teachers are confident that the students absorbed the information conveyed to them, and that they would be able to process the information later. Therefore, the time allocated would be optimally utilized by using the explanation method since teachers have to cover a large amount of the syllabus.

In addition, teachers are inclined to direct questions to students whom they feel will be able to answer the question. This is done to avoid a long wait time in getting a response from students. Some teachers do not like to wait and will immediately change the question to an easier question or direct the question to another student if the first student was not able to provide an answer. Another way of overcoming the difficulty of getting the student to respond is by giving the answer to the question in order to save time (Sulaiman & Noordin 2005). In this case the teachers are faced with the problem of not knowing what is on the students' minds, which leads them to allocate a short wait time after asking a question (Black & Harrison, 2001).

5. Conclusion

Teaching in the classroom is closely related to students' learning, since the students must process all the information contained in the teacher's discussion. Therefore the information put forth by the teacher must be optimally presented in accordance with the students' ability to process the information. The time taken to process complex information is longer than the time needed to process less complex information. Therefore, in order to ensure that adequate time is allocated to students, teachers need to learn to manage wait time as efficiently as possible. This could be done by increasing, awareness of and training regarding the importance of wait time and methods of implementing it, since it is an important element and needs to be consciously implemented.

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References

Albergaria-Almeida, P. (2010). Questioning patterns and teacing strategies in secondary education. *Procesia – Social and Behavioral Sciences, 2*(2), 751-756. http://dx.doi.org/10.1016/j.sbspro.2010.03.096

Baki, R. (2001). *Interaksi Lisan Pengajaran Penulisan Bahasa Melayu daripada Perspektif Guru.* Not published thesis Doctor of Philosophy, Faculty of Education, Universiti Kebangsaan Malaysia.

Black, P., & Harrison, C. (2001). Feedback in questioning and marking: The science teacher's role in formative assessment. *School Science Review*, *82*(301), 55-61.

Bysen, E., & Bysen, F. (2010). Prospective teachers' with-times. *Procedia – Social and Behavioral Sciences*, *2*(2), 5172-5176.

Carin, A. A. (1993). *Teaching Science through Discovery: Questioning and Listening* (7th). New York, NY: Macmillan.

Chin, C. (2006). Classroom interaction in science: Teacher questioning and feedback to students' responses. *International Journal of Science Education*, *28*(11), 1315-1346. http://dx.doi.org/10.1080/09500690600621100

Davivongse, P. (1984). *The effects of a training program on wait-time and the questions asked by junior high school science teacher in Thailand.* Not published thesis Doctor of Philosophy, Oregon State University.

Farrell, T. S. C. (2004). *Reflection on Classroom Communicationin Asia*. Singapore: Longman.

Fries-Gaither, J. (2008). Questioning techniques: Research-based strategies for teacher. *Energy and The Polar Environment* (7 ed.). Retrieved from http://beyondpenguins.nsdl.org/issue/column.php?date=October2008departmentid=professional&columnid=professional!as

Gooding, C. T., & Swift, J. N. (1982). *Modifying teacher questioning behavior in classroom interaction*. Paper presented in Annual Meeting of the Eastern Educational Research Association.

Heinze, A., & Erhard, M. (2006). How much time do students have to think about teacher questions? An investigation of the quick succession of teacher questions and students responses in the German mathematics classroom. *ZMD*, *38*(5), 388-398.

Iksan, H. Z., Mohd Nor, S. N., & Siti Nor Aini Mohd Nor, S. N. (2013). Assessment during the Integration of Lesson Study in Microteaching among Pre-service Teachers. *Asian Social Science*, *9*(16), 112-119. http://dx.doi.org/10.5539/ass.v9n16p112

Martin, R., Sexton, C., & Franklin, T. (2005). *Teaching science for all children: Inquiry methods for constructing understanding* (3rd ed.). New York: Pearson.

Martino, A. M., & Maher, C. A. (1999). Teacher Questioning to Promote Justification and Generalization in Mathematics: What Research PracticeHas Taught Us. *Journal of Mathematical Behavior*, *18*(1), 53-78. http://dx.doi.org/10.1016/S0732-3123(99)00017-6

Morgan, N., & Saxton, J. (2006). *Asking better questions* (2nd ed.). Ontario: Pembroke Publishers

Subramaniam, S. R. (2005). Trainee teacher practices: A case study. *Journal of Science and Mathematics education in S. E Asia*, *28*(2), 96-116.

Sulaiman, T., & Noordin, N. (2005). The application of question levels in the teaching of year one primary school students. *Journal of Science and Mathematics Education in S. E. Asia*, *28*(2), 117-140.

Tincani, M., & Crozier, S. (2007). Comparing brief and extended wait-time during small group instruction for children with challenging behavior. *Journal of Behavioral Education*, *16*(4), 355-367. http://dx.doi.org/10.1007/s10864-007-9047-9

Tobin, K. G. (1980). The effect of an extended teacher wait-time science achievement. *Journal of Research in Science Teaching*, *17*, 469-475. http://dx.doi.org/10.1002/tea.3660170514

Tobin, K. G. (1986). Effect of teacher wait time on discourse characteristics in mathematics and language arts classes. *American Educational Research Journal*, *23*(2), 191-200.

Tobin, K. G. (1987). The role of wait time in higher cognitive level learning. *Review of Educational Research*, *57*(1), 69-95.

Wragg, E. C., & Brown, G. (2001). *Questioning in the secondary school*. London, UK: Routledge/Falmer.

Yang, M. (2006). A critical review of research on questioning in education: Limitation of itspositivistic basis. *Asia pacific education review*, *7*(2), 195-204.

Zainuddin Z. (2005). Pemantapan interaksi verbal dalam pengajaran Fizik melalui pengajaran reflektif: Satu kajian tindakan kolaboratif. Tesis Doktor Falsafah, Fakulti Pendidikan, Universiti Kebangsaan Malaysia.