
"WHAT DO FISHERMEN CATCH?" ; EXPLORING TALK BETWEEN STUDENTS IN PRIMARY SCIENCE CLASSROOM IMPLEMENTING CURRICULUM 2013

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Abstract

The objective of this research is to explore dialogue in primary science classrooms that implement Curriculum 2013. Dialogue is a term used in a broad sense to mean the exchange of information, thought and ideas from the sources to audiences through both written and spoken language. In this study, the sort of dialogue I am interested in is classroom talk; even more specifically, talk between students in the primary science classroom. A case study approach is employed for this study. I am focusing my study on twelve science lessons at year four of one primary schools in the Greater Jakarta. Data were gathered using classroom observations. I wrote a field note for each lesson and record the observation using audio and video recorder. For analyzing the data, I employed socio-culture discourse analysis. The study shows that talk between students during a science lesson is adapted from both a traditional triadic pattern called Initiation, Response, Feedback (IRF) and a non-triadic pattern of Initiation, Response, Feedback, Response, Feedback (IRFRF) chain. Also, the findings indicate that students were able to develop the four domains of scientific literacy through talks during science lessons.

Keywords: Classroom Talk; pattern of interaction; scientific literacy; primary science; science education

Abstrak

Tujuan dari penelitian ini adalah untuk mengeksplorasi dialog di dalam kelas sains dasar yang menerapkan Kurikulum 2013. Dialog adalah istilah yang digunakan dalam arti luas berarti pertukaran informasi, pemikiran dan ide-ide dari sumber pembicara ke lawan bicara melalui komunikasi baik lisan maupun tulisan. Dalam penelitian ini, jenis dialog yang menarik bagi peneliti adalah pembicaraan di kelas; khususnya, pembicaraan antara siswa di kelas sains tingkat Sekolah Dasar. Pendekatan studi kasus digunakan pada penelitian ini. Fokus penelitian ini adalah dua belas materi ajar mata pelajaran sains pada kelas empat dari salah satu sekolah dasar di Jabodetabek. Data penelitian ini dikumpulkan dengan menggunakan observasi kelas. Peneliti menulis catatan lapangan untuk setiap pengajaran dan merekam kegiatan pengajaran menggunakan audio dan perekam video. Untuk menganalisis data, peneliti menggunakan analisis wacana sosial budaya. Studi ini menunjukkan bahwa perbincangan antara siswa selama pelajaran sains diadaptasi dari pola triadic-tradisional yang disebut Initiation (Inisiasi), Response (Respon), dan Feedback (Timbal Balik) yang disingkat IRF dan pola non-triadic yang disebut Initiation (Inisiasi), Response (Respon), Feedback (Timbal Balik), Response (Respon), Feedback (Timbal Balik) yang disebut dengan Rantai IRFRF. Selain itu, temuan menunjukkan bahwa siswa mampu mengembangkan empat domain literasi ilmiah melalui diskusi selama pelajaran ilmu pengetahuan.

Kata kunci: Classroom Talk; pola interaksi; Keaksaraan ilmiah; ilmu dasar; pendidikan sains

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Introduction

A classroom is a place where talk takes place; talk between teacher and students or among students themselves. Talk in the classroom plays an important role in the teaching-learning process. Research on teaching and learning through talk has been carried out over the last forty or so years. In the field of science education, classroom talk has become a central issue in developed countries within the last twenty years. However, this is not a case for Indonesia. There is very little published research on classroom talk in science education.

There are two kind of talk occurs during science lessons, the talk between teacher and students, as well as between students. The interaction between teachers and students usually shows an asymmetrical position in which teachers have more knowledge and more role than the students. According to Vygotsky's perspective, the teacher as the individual with more experience will demonstrate his/her pivotal role in mediating and passing knowledge. Relating to this teacher's role, Bruner (1985) concluded that in following the Vygotskian principle, students learn from their tutors how to understand the world. He further noted: "*There is no way, none in which a human being could master that world without the aid and assistance of others*" (Bruner 1985, p.32). Then, to assist the students, Howe (1996) described how the teacher guides, directs and encourages activities in the social plane to support the learning process

In contrast, to talk between teacher and students, several studies suggest that talk among students is usually more symmetrical than teacher-student conversation because students have equal status and no student has more authority to control talk; anyone can ask a question, anyone can interrupt a speaker. And anyone can disagree with another's opinion

(Mercer and Dawes 2008). Similarly, Fisher (1997) suggested that any initiation of new exchanges by any members is easily found during a talk between students, and questions arise during talk not to test their peers, but rather as genuine attempts to solve the problem. This symmetrical position thus helps students to be responsible for their roles. Consequently, the talk between students will be more dynamic. Students can try out their ideas, see what others think about them and arrange ideas into a different pattern (Barnes 2008). A student can also share and exchange ideas during classroom talk (Teo, 2013). Also, talking between students facilitates comprehension of the rules and procedures. Mercer (2000) described the talking rules in classroom interaction as follows: "*We share our ideas and listen to each other. We talk one at a time. We respect each other's opinion. We give reasons to explain our idea and if we disagree we ask, 'why?' We try to agree at the end*" (Mercer 2000, pp 161-162).

This study is focusing on the nature talk between students in a primary science lesson. To analyze and to understand classroom talk some studies examine the structure and pattern of interaction between teacher and students during the discussion (for example, Sinclair and Coulthard, 1975; Mehan, 1979; Lemke, 1990; Wegerif, 1996; Mortimer and Scott, 2003). Sinclair and Coulthard (1975) identified a three-part sequence movement in classroom discourse called IRF. The classroom talk starts with an initiation (I) from the teacher, which will stimulate students' response (R). Then, this interaction will be followed by the feedback comment from the teacher (F). Similarly, Mehan (1979) identified a cycle of IRE as a typical exchange in classroom interaction. He used E for evaluation instead of F for feedback.

Moreover, since students are encouraged to provide improved responses (Viiri and Sari, 2006), researchers have developed an alternative

to the triadic pattern (Wegerif, 2005; Mortimer and Scott, 2003). Wegerif (1996) introduced the IDRF structure, which proposes a discussion between teacher initiation and students' response. He conducted a study that analyses the pattern of exploratory talk during computer-assisted lessons, in which groups of pupils work with a variety of educational software. During the interaction, it appears that students discuss the lesson with each other. The discussion which occurs between initiation and response move represents the sociocultural aspects during classroom talk. Mortimer and Scott (2003) identified a distinction between open and closed interaction chains. They analyzed talk in the secondary science classroom and found that the teacher offers feedback followed by students' further response. When classroom discussions conclude with feedback provided by the teacher (IRFRF) they are called closed interaction chains, while open interaction chains signify talk which remains open without feedback (IRFRFR).

In addition to the pattern of interaction, I also investigated students scientific literacy development during classroom talk. I used The Programme for International Student Assessment (PISA) scientific literacy to evaluate students' scientific literacy. PISA Framework (OECD, 2016) divide scientific literacy into four domains called context, knowledge, competencies, and attitude. This study looked at how classroom talk supports the development of students scientific literacy.

This article is titled "What do fishermen catch?"; exploring the talk between students in primary science classroom implementing curriculum 2013' in which a fragment of the title is a quote from the utterance in one episode of talk between students. I chose the quote because it represents the focus of this research. The utterance, which is taken from a discussion on the natural beauty of Indonesia (see excerpt

three on results and discussion section), illustrates that students have the background and experience which influence them in presenting ideas and questions during a discussion. This is a sociocultural phenomenon in the classroom talk.

Method

Given the fact that the present study is aiming to explore in depth the talk between students in the primary science classroom in Indonesia which implementing the curriculum 2013, the case study approach employed for this study. This section discusses the case study and the reason I choose the case study, data generation and framework used in data analysis.

A case study is one of the most frequently used qualitative research approaches in the field of social science, including education. Case study methods enable a researcher to explore and investigate contemporary real-life phenomenon through detailed analysis. Yin (2003) defines case study as "an empirical inquiry that investigates a contemporary phenomenon within its real-life context; when the boundaries between phenomenon and context are not evident; and in which multiple sources of evidence are used" (Yin 2003 p. 13). Then, case study can provide opportunities to the investigator to create a comprehensive account of the case and provide detailed information which may difficult to obtain using different approaches.

Considering Yin's three case study parameters and Stake's fur characteristic, I then employed case study for this research. The following paragraph discusses the explanation of parameter and characteristic. Firstly, as described earlier in the introduction that I aimed to focus on what the nature of classroom talk, why the features of nature of talk appear during science lesson and how the nature of talk link with its purpose. Secondly, the research about classroom

talk in Indonesia is very limited and to give the contribution to science education in my country I have to carry out depth exploration on the classroom talk. Finally, as a researcher in this study, I was not participating in classroom activities, and I did not have any authority to control the classroom in which the study taking place.

The data were gathered using classroom observation methods. Observation is an important primary source of data for qualitative research. Merriam (2009) suggests that participant observation is the best methods when activities, event, and situation can see firsthand, Observation is not only questions of looking at something and simply noting down what do researcher need to observe. Gray (2004) reveals that observation is a complex process involving the systematic viewing of the research participant's action, recording what happened during the observation, analysis, and interpretation of their behavior. I employed classroom observation for this study to observe talk between students taking place in the class and to examine the nature of talks and its purpose.

The classroom observation is only half the process of generating data. To be able to analyze, classroom observation should be recorded. There is various way of recording observation, such as writing a field note, audio recording, and video recording (Merriam 2009, Flick 2009, Wragg2002). Each recording approach has advantages and disadvantages. Writing field note can be done immediately, the economy in term of cost and time and can be discussed directly after observation. However, the observer should make decisions what to record, and some activities or participant behavior missed from observation. Using video recording will provide the researcher with good visual and sound record data which can be paly and replay for many times. The researcher has less pressure to make

instant decision and researcher have an opportunity to focus on a particular event and participant. However, some activities and even may go out of camera shot which makes the information missed. Similar to video record, audio recording can be replayed several times for data analysis purpose. However, audio recording cannot be capture visual expression such as gesture, body language, facial expression. Considering the advantages and disadvantages of recording approach for classroom observation, I wrote a field note for each observation and record the observation using audio and video recorder.

I carried out the classroom observation during 12 science lessons at year four of one public primary schools in the southern part of greater Jakarta. The teacher of this class is a senior teacher. She has been teaching for more than thirty years. She started teaching in 1982 after completing her education at the Sekolah Pendidikan Guru (a vocational high school specializing in teaching primary school). When the government introduced regulations that primary school teachers should have a bachelor degree in early 2000, she enrolled in a distance learning program offered by the Indonesian Open University. She completed her degree during the mid-2000's. She teaches 42 students, 22 of which are females and 20 of which are male students. This is quite a large classroom size even for a public school. Based on my observation and conversation that I had with Mrs. Diana and her students, I noticed that the students come from the different socio-economic background.

Data gathered then analyzed using the sociocultural discourse analysis introduced by Mercer (2004) which is relevant to my research questions and theoretical framework. Mercer (2004) suggested that sociocultural discourse analysis has its characteristic and differs from other approaches. It is because this approach is

not only concerned with the process of classroom interaction, but also with the outcome of the interaction studied by the researcher. Further, Mercer (2004) demonstrated that sociocultural analysis is beneficial for the researcher to understand how speaker share ideas and use talk to joint construction knowledge. It can be used to look at how speakers construct the contextual foundation of their talk and how the talk relates to the historical and cultural aspect of the speaker. This theoretical framework has been used to analyzed the data from classroom discourse to look at various aspect of collective thinking and the classroom such as the pattern of interaction, communicative approach, and purpose of talk.

Results and Discussion

This section will discuss the finding based on three excerpts from talk occurs between students.

Excerpt 1: Talk between students on a pine tree

This following episode is taken from group discussions when students discussed the benefits of pine trees.

- (1) David: Pine can produce paper.
- (2) Ben: No. People can take benefits from a pine tree, or pine trees is the raw material for producing paper.
- (3) Joe: Which part of the pine?
- (4) David: Hmmm... maybe the bark.
- (5) Joe: What else?
- (6) Ben: We can also produce essential oils from the pine tree.
- (7) Joe: What is essential oil?
- (8) Ben: Hmm I don't know... the book says essential oil. It may be similar to massage oil.

This episode started with David's presentation of his idea that *pine can produce paper*. This initiation was different from what teachers do. The initiation was not a question. Instead, this was a willingness to initiate a dialogue and to say something. In response, Ben corrected David's idea and presented his knowledge using appropriate language: *people can take benefits from pine trees or pine trees are the raw material for producing paper*. Then, Joe maintained the dialogue by delivering a probing question: *which part of the pine?* The dialogue was continued by Ben's response, followed by another probing question from Joe. Moving to the end of the dialogue, the structure of this episode was not the standard traditional IRF, but instead, the structure was an IRFRF open chain.

Usually, the person who initiates dialogue takes a role in maintaining it. However, in this case, this did not happen. David did not lead the dialogue; indeed, Joe interjected to uphold the discussion, starting at utterance three. It is very clear that Joe was not using his voice in delivering questions—what else and what is essential oil? Indeed, his voice tried to mimic the teacher's authoritative voice. Joe learned from classroom interaction that the teacher usually uses such language to encourage children to talk; he changed the position from listener to speaker.

Moreover, it is recognizable that David, Joe, and Ben engaged in uncritical talk. They constructed the idea of the benefits of pine trees without any challenge and/or counter arguments. David did not respond to Ben when his idea was corrected. Joe did not engage David's idea of pine bark. Then, Ben presented his idea just to answer Joe's question without further explanation. This kind of interaction and the authoritative sign in this dialogue shows that the episode followed the authoritative interactive approach.

Also, regarding student' development of scientific literacy, the episode showed that students were able to demonstrate their understanding and knowledge of the benefits of pine trees. This highlights the students' competency in explaining the phenomena scientifically, as illustrated in utterance 2, whereby Ben identified and explained one benefit of pine trees using the appropriate language; and utterances 4 and 8, in which David and Ben offered hypotheses based on the sources they had read.

Excerpt 2: Talk between students on electronic appliances in daily life

This dialogue was instigated when students were asked to discuss technology in pairs, based on the task set out in the textbook. The textbook presented pictures of electronic appliances used in daily life. Students were asked to consider what would happen if the appliances were used continuously and the reasons for it. In addition to that question, students were also asked if they could make such an appliance for helping human activities.

Dessy: What will happen if electronic appliances are used continuously?

- (1) Nina: They will be broken.
- (2) Dessy: What do you mean?
- (3) Nina: They will be broken if we use them continuously
- (4) Dessy: What is the reason?
- (5) Nina: Hmm no idea.
- (6) Dessy: It may *not work anymore* I think.
- (7) Nina: Next, if you were asked to make an electrical appliance to help humans, what would you make?
- (8) Dessy: Magic jar to cook rice
- (9) Nina: Why?
- (10) Dessy: So one will not be tired when cooking rice; the rice will stay warm and ready to eat at any time. Or I may make an automatic iron.
- (11) Nina: What for?

(12) Dessy: So it will help ironing, and the clothes are always tidy.

(13) Nina: What is its drawback?

(14) Dessy: A *hot iron* can leave burn marks on *clothing*.

This dialogue began when Dessy read the question from the textbook. It can be said that Dessy initiated this dialogue by conveying the question "What will happen if electronic appliances are used continuously?" Nina responded to this question and stated that the equipment might be damaged. Dessy showed her feedback by asking for confirmation of what Nina meant by "damaged." Nina then repeated and confirmed that the equipment would be damaged if used continuously. Wanting to explore further, Dessy asked Nina's opinion about the reasons for it being damaged. However, Nina did not have any ideas, so Dessy concluded that the equipment would be finished. In this case, Dessy might have used the word 'finish' to describe that the appliance could no longer be used.

After this, Nina took over the role as the pupil who asked by delivering the question "What would you make if you were asked to make an electronic appliance to help humans." In response to this question, Dessy conveyed the idea of making a rice cooker. Exploring Dessy's idea, Nina asked her why she wanted to make a rice cooker. Dessy did not only give a reason why she wanted to make a rice cooker but brought a new idea: making an automatic iron. The dialogue then became extended by Dessy reasoning and the drawback of an automatic iron.

From the above description, a traditional IRF pattern emerged. However, interestingly, the episode did not follow the standard IRF model. In the traditional IRF, the teacher acts as initiator and feedback provider, while students are responders. It did not appear to happen in this dialogue. Both Dessy and Nina shared the

same role. At the beginning of the episode, Dessy took the position of the initiator and gave feedback, while at the end Nina took this role. This evidence shows that the two students had the same position: none of them had dominance and had a higher authority.

Although the dialogue followed the guidance of the textbook, the ideas presented by the students were not derived from the textbook. Instead, they were coming from their daily experience. Perhaps Nina's idea came from her experience of having electronic appliances that are damaged when they are used continuously. Similarly, Dessy showed her language by saying that the appliance would finish. Moreover, having daily experience in helping parents cook rice and ironing, or seeing that her parents are busy cooking and ironing, Dessy developed the idea of creating a rice cooker and an automatic iron. The rice cooker and iron are related to housework, and in the Indonesian context, these activities are done by women almost exclusively. This evidence reveals how science connects strongly with daily experience.

About the development of scientific literacy, this episode shows how the four domains of scientific literacy developed through dialogue. Firstly, the topic discussed on electronic appliances which related to their life can be categorized as a personal context. Next, their involvement during discussion and curiosity to explore their peer's ideas indicated an interest in science and technology, thereby representing the attitude domain. The scientific knowledge domain could be identified from Nina and Dessy's ability to link their ideas with experience in using electronic appliances in daily life. Finally, their explanation of how the equipment could be useful for society emphasizes how their competencies evolved through this dialogue.

Excerpt 3: Talk between students on the natural beauty of Indonesia

The dialogue commenced when students were learning the theme of the natural beauty of Indonesia. Students were asked to work in groups of four just by joining up with the next table. As suggested in the textbook, the teacher asked the students to write and discuss questions related to the picture. I observed one group's discussion, and the excerpt of their talk is presented below.

- (1) Darin: What do fishermen catch?
- (2) Jon: Fish.
- (3) Dessy: When do fishermen leave home to catch the fish?
- (4) Daniel: Morning time.
- (5) Darin: Why?
- (6) Daniel: So they can go back home in the afternoon.
- (7) Jon: They may leave home in the morning after Fajr (morning) prayer and get back home in the afternoon.

(Teacher walked around and came to this group and observed the discussion)

- (1) Daniel: It can be. What do they use to catch the fish?
- (2) Darin: A fishing net.
- (3) Jon: A bomb.
- (4) T: Bomb? Are they allowed?
- (5) Daniel: No, not allowed.
- (6) T: Why?
- (7) Daniel: Because it damages the environment.
- (8) Dessy: Fish and other sea creatures will die

In response to the teacher's instruction, Darin instigated a discussion by asking one question: "What do fishermen catch?" Jon responded with a short answer - "Fish" - leading Dessy to raise a further question: "When do

fishermen leave home to catch the fish?” They discussed the time and agreed that fishermen leave their home in the morning. Then Daniel asked: “What do they use to catch the fish” followed by student and teacher responses. Similar to Dialogue #2, the pattern of this episode is adapted from the sequence of IRF pattern.

This dialogue is very interesting because the ideas raised by the students are quite far removed from what was presented in the picture, although there are linkages. The figures depict five incredible landscapes, including Bromo Mountains, rice terraces, islands of Raja Ampat and Lake Toba, and the Borneo rainforest. The lesson anticipates that students will discuss the beauty of these landscapes. However, instead of discussing the natural beauty of the images presented, students embarked on a conversation about fishing, possibly because two of the five images depict the sea and a lake. Similar to the other episodes, this session reveals that students had previous experiences that they attempted to relate to the subjects under discussion.

Furthermore, it is noteworthy that the students held the same position and role, regardless of their gender. Although the dialogue began with the initiation of female students, no one dominated the talk or had greater authority. Pupils shared the roles of asking questions and providing answers and feedback. Darin asked at the beginning and then became a student who answered, as well as Dessy and Daniel. Only Jon did not raise a question in this instance.

Moreover, while the four initial utterances displayed the dynamic of conventional question-answer talk, dialogue evolved into a more interactive discussion because students were actively involved and engaged. The students presented their ideas and shared their knowledge. For example, Daniel conveyed the idea of a fishing time asserted by Jon. Darin presented the idea of a fishing net when Daniel asked about

the tools used to catch fish, followed by Jon’s idea of using a bomb. Students also showed their willingness to explore their peer’s ideas. An example is Darin’s question, “Why?” when Daniel presented his idea on fisherman’s working time. It shows how the nature of the dialogic approach appeared here. It is evident that the talk between students in a science classroom can be considered as scaffolding in learning. The interactions that occur both in the larger classroom discussions and during group work help students to develop their skills in mastering science mastering the content of science lessons. This certainly confirms that classroom talk can assist students in developing their potential within Zone of Proximal Development. By interacting with teachers and peers, students can develop their potential, which may not be achieved if they learn individually (Vygotsky, 1978).

Moreover, regarding scientific literacy development students showed their competencies in presenting questions and providing hypotheses. For example, when discussing fishermen working times, although they did not have sufficient knowledge, the students offered a hypothesis that fishermen leave home early morning and return in the afternoon. In reality, fishermen work at night. Perhaps students considered fishermen as a profession, so they have similar working hours to other professionals. They also attempted to see the religious aspect. In this case, one student mentioned that the fishermen leave home after morning prayer. Additionally, the topic of using bombs in fishing revealed that students were concerned with environmental issues. Daniel proposed the notion that using bombs in fishing would damage the environment, while Dessy added that it would kill fish and other sea creatures.

Conclusion

In general talk between students during a science lesson is adapted from both a traditional triadic pattern called Initiation, Response, Feedback (IRF) and a non-triadic pattern of Initiation, Response, Feedback, Response, Feedback (IRFRF) chain. The second pattern occurred more frequently because students have a more symmetrical position.

In relate to scientific literacy, students were able to develop the four domains of scientific literacy through talks in classroom discussion. In term of context, the data shows that students have been able to raise and discuss issues related to themselves, family, neighborhood and global issues during the talk. In the aspects of knowledge, the current study shows that classroom talk supports students' development of content knowledge (i.e. students can associate their daily experience with the topic they discussed), procedural knowledge (i.e explaining the process of making or cultivating certain things which involve scientific processes), and epistemic knowledge (i.e. students can raise scientific questions and deliver their hypothesis). In relate to competency domain, the study demonstrates that talk during science lessons supports students in developing their scientific competencies, especially competencies related to the ability to identify and submit questions on science topics, explain scientific phenomena, interpret data and evidence scientifically. And finally, in term of attitude, the finding suggests how students show their interest in science, commitments, and enthusiasm in doing experiments during the talk. The data also present how the student is aware of the environment issue and can raise ideas to relate to the environmental problem.

References

- Barnes, D. (2008). Exploratory Talk for Learning. In *Exploring Talk in School Inspired by the Work of Douglas Barnes*. London: Sage Publication.
- Bruner, J. (1985). Vygotsky: An historical and conceptual perspective. In J. V. Wertsch (Ed.), *Culture, communication, and cognition: Vygotskian perspectives* (pp. 21–34). London: Cambridge University Press.
- Fisher, E. (1993). Distinctive features of pupil-pupil classroom talk and their relationship to learning: How discursive exploration might be encouraged. *Language and Education*, 7(4), 239-257.
- Flick, U. (2009). *An introduction to qualitative research*. Los Angeles: Sage Publications.
- Gray, D. E. (2004). *Doing research in the real world*. London: Sage Publications.
- Howe, A. C. (1996). Development of science concepts within a Vygotskian framework. *Science Education*, 80(1), 35-51.
- Lemke, J. L. (1990). *Talking science: Language, learning, and values*. Norwood, NJ: Ablex Pub. Corp.
- Mercer, N. (2000). *Words and minds: How we use language to think together*. London: Routledge.
- Mercer, N., & Dawes, L. (2008). The Values of Exploratory Talk. In *Exploring Talk in School: Inspired by the Work of Douglas Barnes* (pp. 55-71). Sage Publication.
- Mercer, N. (2007). Sociocultural discourse analysis: analysing classroom talk as a social mode of thinking. *Journal of Applied Linguistics*, 1(2).

- Merriam, S. B. (2009). *Qualitative research: A guide to design and implementation*. San Francisco: Jossey-Bass.
- Mehan, H. (1979). *Learning lessons: Social organization in the classroom*. Cambridge, MA: Harvard University Press.
- Mortimer, E., & Scott, P. (2003). *Meaning Making in Secondary Science Classrooms*. Open UP.
- OECD. (2016). *PISA 2015 Assessment and Analytical Framework: Science, Reading, Mathematic and Financial Literacy*. Paris: OECD Publishing
- Sinclair, J., & Coulthard, M. (1975). *Towards an analysis of discourse: The English used by teachers and pupils*. London: Oxford University Press.
- Teo, P. (2013). 'Stretch your answers': Opening the dialogic space in teaching and learning. *Learning, Culture and Social Interaction*, 2(2), 91–101.
- Viiri, J., & Saari, H. (2006). Teacher Talk Patterns in Science Lessons: Use in Teacher Education. *Journal of Science Teacher Education*, 17(4), 347-365.
- Vygotsky, L.S. (1978), *Mind in Society. The Development of Higher Psychological Processes*. Edited by M. Cole, V. John-Steiner, S. Scribner & E. Souberman Harvard University Press. Cambridge, Massachusetts: Harvard University Press.
- Wegerif, R. (1996). Using computers to help coach exploratory talk across the curriculum. *Computers & Education*, 26(1-3), 51-60.
- Wegerif, R. (2005). Reason and Creativity in Classroom Dialogues. *Language and Education*, 19(3), 223-237.
- Wragg, E. C. (2002). *An introduction to classroom observation*. London: Routledge.
- Yin, R. K. (2003). *Case study research: Design and methods*. Thousand Oaks, CA: Sage Publications.