

# THINK-ALoud PROTOCOL ANALYSIS, A PATH TO PROCESS STUDIES: WHAT, WHY AND HOW

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*Alderson (1984:23) claims that future research will have to focus upon individuals, and be specifically designed to allow a detailed examination of the nature of the learners' abilities, strategies, knowledge, attitudes and motivations, and any other variables that appear to be of relevance. This claim is supported by Barmby, Bonham, Lawry & Nissner (1985:11), Block (1986:463), Djiwandono (1993:49) and Sugirin (1997:1) who point out that knowledge about the process, not just the product, is needed in order to design programs which truly meet the needs of the students. However, process studies pose challenges to researchers. As Sugirin (2002) observes, the paucity of the process studies in TEFLIN appears to be a consequence of the complexities the studies involve.*

*This paper aims at providing a detailed description of the think-aloud protocol analysis as a path to process studies in TEFLIN, rationales for its use, and guidelines for its application. The paper will also provide methods complementary to the think-aloud protocol analysis and examples of their application in reading, followed by a discussion on the research findings. The paper will be concluded with implications of the studies on classroom practice and suggestions for the teachers.*

## 1. Introduction

Alderson (1984:23) claims that future research will have to focus upon individuals, and be specifically designed to allow a detailed examination of the nature of the learners' abilities, strategies, knowledge, attitudes and motivations, and any other variables that appear to be of relevance. This claim is supported by Barmby, Bonham, Lawry & Nissner (1985:11), Block (1986:463), Djiwandono (1993:49) and Sugirin (1997:1) who point out that knowledge about the process, not just the product, is needed in order to design programs which truly meet the needs of the students. However, process studies pose challenges to researchers. As Sugirin (2002) observes, the paucity of the process studies in TEFLIN appears to be a consequence of the complexities the studies involve. A common practice of conducting research based on grants or projects, often with a very short period of time, also discourages researchers from doing process studies, which, due to their complexities, generally require a longer period of time. That process

studies often require the collaboration of two or more parties may also cause another challenge.

One of the process study methods that has gained wider acceptance since the eighties is an analysis of verbal reports known as the think-aloud protocol analysis. The next sections of the paper will provide details of “the what”, “the why” and “the how” of this method.

## **2. What is a think-aloud protocol analysis?**

Think-aloud protocol analysis or the think-aloud protocol method was developed by Newell and Simon to study cognitive problem solving strategies. In their first think-aloud protocol study in 1960, Newell and Simon (1972:165) employed a single participant who was a male college student at Carnegie Institute of Technology. The procedure was simple. The participant was seated at a table with a paper and pencil; the instructions of a mathematical puzzle were read to him and the sum was written down in conventional form. In addition, the participant was asked to speak aloud at all times while he worked, and his verbalisations were tape-recorded. It is the transcription of the tape-recorded verbalisations that Newell and Simon (1972) call the “think aloud protocol”, while “think-aloud protocol analysis”, according to Wallace (1998:258), is “the act of submitting transcripts and similar written records to systematic examination.” It is the process of arriving at the problem solution that the systematic examination is interested in.

In its history of application there have been variations and confusion, and controversy, due to the different interpretations of the think-aloud protocol itself. This controversy died down when Ericsson provided explanation regarding the verbal report that was believable, that is, which was concurrent with the execution of a problem-solving task. Various studies based on different interpretations of think-aloud protocols allow us to obtain a better understanding of the nature of good think-aloud protocols.

Pressley and Afflerbach (1995) observe that the applications of think-aloud method varied tremendously. The variations were, among others, related to familiarity with

think-aloud processes and practice in thinking aloud, which may affect degrees of concurrency, goals in regard to the given tasks, and the care taken to avoid biasing.

In regard to the care taken to avoid biasing, Pressley and Afflerbach's (1995:22) review on studies using methods under the label of think-aloud protocol analysis shows that these studies varied greatly with respect to reported processes. At the one extreme, as part of instructions, the researcher modelled thinking aloud, providing some information about what the reader might do. For example, Afflerbach (1990) told participants that he was interested in their predictions, elaborations, and inference. At the other extreme, the researchers make absolutely no comment on what processes might be reported. One of those researchers was Olshavsky (1976-7), who did not make any comment on thought processes but merely told the participants to read a story and talk about what happened in the story when they came to a dot placed after each independent clause. Somewhere in the middle was a study like Lundeberg's (1987), in which the readers were asked to be like a teacher in their report processing, revealing their thought processes as a teacher would to a student. Pressley and Afflerbach (1995:22) claim that, in general, the variability in directions was because the investigators were interested in different processes and different aspects of reading, and probably believed that a particular request or series of requests would get them what they were looking for.

Despite differences in the extent of possible bias resulting from the variability of the instructions, Pressley and Afflerbach (1995:1) observe that studies using verbal reports during the past three decades have provided a rich collection of data, and have allowed the process of refinement towards maturity of the research methodology to take place. One of the indicators of this process of refinement was the publication of works clarifying different types of verbal reports. Among these works is Kormos's (1992) article, which provides the clearest explanation of different types of verbal reports, distinguishing think-aloud from retrospective and introspective reports.

In *think-alouds* (or concurrent verbalisations), researchers instruct their participants to verbalise directly only the thoughts entering their attention while performing the task. The verbal reporting is concurrent with the execution of a specific task, and the participants provide information while it is still available to them – that is, while it

remains in short-term memory (STM). For example, research participants can be asked to think aloud while translating a sentence from their L1 to their L2 and to report the sequence of thoughts related to the selection of appropriate words and grammatical structures while doing the translation (Kormos, 1992:353).

For *introspection*, participants are not only requested to verbalise but also to describe or explain their thoughts. Introspection therefore entails the activation of information that is not stored in STM during the performance of the task; consequently, the reliability of these types of reports has proven to be highly questionable Kormos (1992:353-4). Introspection was also the type of verbal reports Watson (1920) bitterly criticised due to his doubt about the believability of data obtained. Nisbet and Wilson (1977) revived this criticism for the same reason. In *retrospection*, on the other hand, the participants verbalise their sequence of thoughts after they perform the task. In this case, the relevant information needs to be transferred from the long-term memory (LTM) to STM, which might result in incomplete reporting (Kormos (1992:354).

Researchers wishing to adopt think-aloud protocol method in their studies should not confuse the method with introspection or retrospection, which has also been used under the label of think-aloud protocol method or think-aloud protocol analysis. The variation in the applications of the think-aloud protocol analysis mentioned earlier provide researchers with valuable data from which they can decide which way to take to suit the purposes of their studies while attempting to approximate the application of the think-aloud procedures as specified by its authorities such as Ericsson and Simon (1984/1993). As Kormos (1992) reiterates the think-aloud protocols considered believable are those representing “concurrent verbal reports”.

### **3. Why should we use think-aloud protocol analysis?**

Two points will be presented as rationales for using think-aloud protocol analysis: quantitative/qualitative inquiries and assumptions underlying verbal protocols as valid mentalistic data.

#### **3.1 Quantitative/qualitative inquiries and empirical/mentalistic data**

A common way of classifying studies is by categorising them into two basic research traditions: positivistic, empiricist research using quantitative methods, and naturalistic, interpretive, descriptive research using qualitative methods. Taylor and Bogdan (1984) term the two basic research traditions “positivism” and “phenomenology”, respectively. According to Taylor and Bogdan (1984:1), positivists seek the facts or causes of social phenomena apart from the subjective states of individuals, while phenomenologists are committed to understanding social phenomena from the actor’s own perspective. Adopting a natural science model of research, the positivists search for causes of social phenomena through methods that produce quantitative data amenable to statistical analysis, while phenomenologists seek understanding through qualitative methods that yield descriptive data (Taylor & Bogdan, 1984:2).

According to Wallace (1998:38), the term “quantitative” is broadly used to describe what can be counted or measured and can therefore be considered objective. On the other hand, the term “qualitative” is used to describe data which are not amenable to being counted or measured in an objective way, and are therefore subjective. Thus, in researching a language lesson, it is quite easy for us to measure (with a stop watch, for example) the amount of “teacher talk” as against “pupil talk”, or the amount of use of target language as opposed to the mother tongue. Such data are amenable to a quantitative approach. Alternatively, a researcher could interview the teacher (and/or the students) involved in the lesson and ask what comments they had on the lesson. The researcher might ask the teacher, “Did everything go according to plan? Was he or she pleased or disappointed with the lesson as a whole? Would he or she teach it in the same way next time?” The researcher might ask one of the students, “How interesting was the lesson for him or her? Was it easy to understand?” The responses to individual interviews cannot easily be measured quantitatively, but the data (i.e. the replies) might actually be more interesting to practising teachers than statistics about the quantity of teacher talk (Wallace, 1998:38).

Eisner and Peshkin (1990:367) claim that qualitative inquiry pervades human life, and qualitative thought is a requirement for maintaining one’s humanity. As a matter of fact, qualitative inquiry is exercised in all forms of human activity. For example, the fine-grained adjustments that good teachers make in speaking to individual children, their

vision of options that can be pursued in a classroom, their assessment of levels of student interest and motivation, and their assessment of their written and verbal expression - all require the use of qualitative thought.

While reading comprehension, the product of reading, can be easily measured quantitatively, for example by counting the number of comprehension questions a reader can answer correctly after reading a given passage, the reading comprehension process involves qualitative thought processes that cannot always be measured quantitatively. The reading comprehension process, which is considered a problem-solving process (Hosenfeld, 1977), involves thoughts that wander or rush through the minds of readers, the searches and struggles for meaning (Block, 1986:463). Aspects such as the frequency of uses of particular strategies, for example, can be counted or measured quantitatively, but to understand what strategies are used and how they are used requires a qualitative account of the complex comprehension processes which can only be achieved through qualitative approaches.

Therefore, there should be no real opposition or contradiction between the two approaches. As Nunan (1992:3) suggests, more recently, a binary distinction between quantitative and qualitative research has been considered simplistic and naive. Researchers should also realise that assigning “objective” and “subjective” labels to research data can be misleading, because, consciously or sub-consciously, aspects of the research such as variables, methodologies, and data analysis are all the result of researchers’ (subjective) choices. Wallace (1998:38) points out that quantitative data can throw light on qualitative insights and vice-versa.

Another way of categorising research studies is by looking at whether the data is generated by “looking inward” (introspective or mentalistic data), or by “looking outward” (empirical data). Empirical research is done by looking outward, closely observing certain aspects of the world around us, examining objective material things. These observations can usually be checked by other people. On the other hand, there may be no other way of even getting a hint of how people think than by conducting introspective research. What people think or feel may be just as important as any other kind of data. Data about what people think can only be obtained by asking people to

look inward, examining their own thoughts (Wallace, 1998:39). For this very reason, Wallace (1998:88) justifies the use of verbal reports or think-aloud protocols as introspective research data.

Wallace (1998) suggests another reason for the renewed interest in introspective methods generally, which has something to do with the enhanced status of experiential knowledge of the teacher and of the learner. Wallace (1998:89) notes that at one time it seemed to be assumed that the only knowledge worth bothering about resided with the “experts” who were often academics spending most or all of their time engaged in funded research projects located in universities. In more recent times, however, the beliefs, attitudes and experiential knowledge of both teachers and learners are also recognised as important factors in learning and teaching. Wallace (1998) points out that verbal reports, and other introspective techniques, are ways in which these factors can be articulated and given due weight. In fact, verbal reports or verbal protocols as research data in process studies already have a long history.

### **3.2 Verbal Protocols as Mentalistic Data**

The assumptions that underlie verbal protocol analysis are that verbal behaviour is seen as one type of recordable behaviour (Ericsson & Simon, 1984:9), that information in focal attention is available for verbalised reports (Jourdenais, et al., 1995:188), and that information that is reported is information that is heeded (Ericsson & Simon, 1984:167). Ericsson and Simon (1993) point out that verbalisations such as those obtained during the performance of a think-aloud task allow researchers to observe processes of participants, without influencing the sequencing of thoughts. This was subsequently supported by Stratman and Hamp-Lyons (1994), who hypothesised that concurrent think-aloud tasks would interfere with participants’ cognitive processes. However, their experimental studies could not confirm the hypothesis. Stratman and Hamp-Lyons (1994:109) concluded that the think-aloud tasks did not interfere with, but merely slowed down, the thought processes.

Ericsson and Simon (1984; 1993) realise that think-aloud protocol method has its limitations. One of the limitations is that sometimes one’s thoughts are not fully coherent, and verbalisations of thought processes are not always complete. However, if

the self-report is concurrent, it is, at least, a subset of the information actually heeded in STM when doing the task. As it is STM that is used for actively solving problems and that the contents of STM are amenable to conscious inspection, concurrent verbal reports or think-aloud protocols reflect what is actually running in the brains and are, therefore, valid as data. Other limitations of think-aloud protocol studies include the need for a longer period of time and the collaboration of two or more researchers familiar with the think-aloud protocol analysis.

Despite its limitations, Ericsson (1988:321) suggests that verbal report methodology makes it possible to study phenomena which have been difficult, if not impossible, to investigate by traditional research methods. Kormos (1998:357) claims that, in fact, some of the information gained in this way cannot be elicited by means of any other technique. This is supported by Wallace (1998:88), who points out that one reason for using verbal reports is that if verbal reports are not used, significant areas of interest will be closed to investigation. Some of the things that interest us more are not always available to straightforward observation. The choice for most researchers is either to give up on whole areas of professional interest, or else to glean what they can, while remaining aware of the limitations of whatever techniques they use. As one form of verbal reports, think-aloud protocol method allows researchers to go beyond the common practice of analysing FL/L2 speakers' competence solely on the basis of performance data.

Despite advancement in the concept and use of protocol analysis, further studies still need to be done. As Pressley and Afflerbach (1995:1) put it, protocol analysis is a maturing methodology with much interesting work already accomplished and considerable work to be done. If processes are considered important in designing a program which truly meets the learners' needs, then it is necessary that the program be based on the current learning processes of the learners. Think-aloud protocol analysis offers a path to studying such processes.

#### **4. How do we apply think-aloud protocol analysis?**



The application of the think-aloud protocol analysis will start by looking at two distinct data collection procedures: basic data collection and data collection involving the utilisation of complementary techniques.

#### **4.1 Basic Data collection procedures**

Research data collection involving think-aloud tasks requires the researcher to understand the exact nature of the think-aloud method and its limitations. There are two steps researchers should go through in the data collection: giving think-aloud practice run and assigning actual think-aloud tasks.

##### **4.1.1 Think-aloud practice run**

Ericsson and Simon (1993) claim that thinking aloud is a natural enough process that lengthy training is not required. However, an appropriate level of performance is desired to insure that the participants provide the kind of information the study intends to obtain. For this purpose, a practice run is a necessity. The researcher should not give an example of the think-aloud activities as the participants may model the example and, consequently, their responses will not be purely theirs. An important recommendation in the think-aloud task is that the directions given to research participants should be such as to discourage them from providing descriptions or explanations of their thought processing (Pressley & Afflerbach, 1995:10). The directions should specify clearly that the participants are invited to report exactly what they were thinking while reading (to provide “concurrent” or “on-line” verbal reports); they should be explicitly instructed to verbalise all the thoughts that occurred to them while doing a given task (e.g. reading a text). This leads the participants away from the role of interpreter. It is the researcher’s role to make inferences from the participants’ responses. In order that the participants report exactly what they were thinking while working on a problem-solving task, they should be free to talk in the language or mixed languages with which they feel most comfortable.

The following is an example of directions given to participants of a think-aloud task in reading:

“Please read the following text sentence by sentence. Upon reading each sentence, tell me exactly what you were thinking while reading. If you

had any problems, tell me what the problems were and what you did to solve them. I do not want you to theorise about your thought processes, but just tell me exactly what came up to your mind while reading. What I need to know is how you made sense of the sentence you were reading. You may talk into the tape in English, Indonesian, or mixed Indonesian and English. There is no time limit, but do your best to complete the task as soon as possible. When you keep silent for more than fifteen seconds, I will raise this TALK sign. The raising of this sign has nothing to do with the content of your talk, but it is meant to remind you to keep talking about what you were thinking.”

To insure that the participants understand the instruction, it may be repeated in the participants’ first language.

For a think-aloud practice run in reading, the text used should be of an appropriate length to give participants enough reading material for the practice run. Participants do not have to finish reading the whole passage; some may need only three or four paragraphs to rehearse, while others may need more, in order to achieve an appropriate level of think-aloud performance.

#### **4.1.2 Think-aloud task**

When participants have achieved an appropriate level of performance, the actual think-aloud task may start. The directions given before the practice run are repeated for the actual think-aloud task. The researcher should ask whether the directions are clear to the participants before the actual think-aloud process start. This is intended to minimise interruptions, and hence, the distortion, of the process by either the researcher or the participants themselves. This way, it is expected that the participants’ responses will be purely theirs, free from the researcher’s interference. However, in the actual data collection process, if the participant’s think-alouds or responses have not reflected any clue of his/her thought processes, the researcher may ask for clarification by saying “What do you mean by that?” or “Could you explain that?” In order to encourage the participant to maximise the reports, the researcher can show his/her attention by using expressions such as “Uh-huh,” “Yes,” or “Yeah.”

When the participant is ready, he/she may start talking into the tape or thinking aloud the thoughts entering his/her mind. To make sure that the tape recorder works properly the researcher must test the recording machine before the actual data collection starts.

#### **4.2 Procedures in data collection involving complementary methods**

When the method is used in conjunction with other methods, precautions must also be taken against possible effects of reactivity - interference with participants' cognitive processes (Stratman & Hamp-Lyons, 1994). In the light of these necessary precautions, the participants are not told about the following tasks before the think-aloud task is completed. In the case of the writer's study on reading comprehension strategies (Sugirin, 2002), which complemented think-aloud task with *retellings*, *multiple-choice test* and *interview*, the participants were not informed about the multiple-choice questions before completing retellings. They were not told about the interview, which included discussion on the test answers before completing the test. The researcher planned the instructions and the tasks in such a way that task performance would be spontaneous. This was in line with Ericsson and Simon's (1980; 1993) suggestion that participants should not be informed of the subsequent retrospective interview before the completion of the think-aloud task; otherwise the foreknowledge might affect their performance.

#### **5. Ethics issues**

As a think-aloud protocol study requires earnest participation of the research participants, issues in regard to ethics requirements should receive due attention. Other than obtaining permits from relevant authorities, the researcher should also obtain agreement from the participants that they will participate voluntarily in the study as proven by signed consent forms. Permits and signed consent forms are necessary to protect the privacy of the participants and to maintain the good research conduct so that the reported results will not raise questions of accountability. To guarantee the participants' sincerity in their participation, aspects related to the participants' privacy and comfort, such as timetabling, location of the room, and the setting up of the recording

equipment need the researcher's attention. The researcher should also point out that participants are free to withdraw their consent and end their participation if they feel unhappy with any aspect of the research study, and that it will not, in any way, affect their academic standing as students, if the participants are students.

## **6. Analysis of the data**

In general, the analysis of the think-aloud protocols starts by transcribing tapes of the responses to the think-aloud task. Depending on who the readers will be, if the research participants responded in mixed languages, portions of the responses may require translation. The translated version of the transcripts is then coded. One of the coding models that has received wide acceptance is Strauss & Corbin's (1990) coding model.

### **6.1 Coding of the protocols: Grounding of codes on data**

Think-aloud protocols or transcripts constitute the main data in a think-aloud study. A grounded theory approach (Strauss, 1987) is an approach to data whereby codes are derived from what the participants were doing or were assumed to be doing, and no attempts are made to impose pre-determined codes on the data. However, where it is of help and suits the data, known concepts can be adopted or adapted as codes. In the process of coding, a researcher may employ systematic use of every first letter (initial) of concepts pertaining to, for example, what a reader was doing. For example, a strategy of "making inter-sentential relation" is represented by the code (MIR or MISR). Another researcher may use the key word or the initial part of the key word of a strategy as the code. For example, "making inter-sentential relation" is coded as "Inter." In this regard, the researcher selects codes based on forms that will be easily recognised.

In a grounded theory approach, research data undergo three coding stages: *open* coding, *axial* coding and *selective* coding (Strauss, 1987). An *open coding* means unrestricted coding of data by scrutinising the transcripts very closely in order to produce concepts that seem to fit the data in regard to the issues pertaining to conditions and strategies. It also means that in the initial stage of coding, all the phenomena in the data have an equal opportunity to be represented by certain codes despite the change, which may

occur after relating them to the two categories mentioned earlier. Thus the open coding verifies and saturates individual codes. Labelling of codes may be changed if better terms are invented later. As Strauss (1987:29) illustrates, the analyst learns to play the game of believing everything and believing nothing - at this point - leaving him or herself as open as the coding itself.

In the next step, the results of the open coding are examined *axially*, by applying *axial coding*. An *axial coding* is the intense analysis done around one category at a time in terms of the paradigm items. It may also be said that the analysis revolves around the *axis* of one category at a time. For example, if the problems in comprehending a text make the core category, all problems such as problems with vocabulary, problems with sentence structure, problems with text structure, etc. will be clustered under the core category of comprehension problems. If the vocabulary problems are considered to be the core category, then problems such as synonyms, antonyms, cognates and non-cognates, and so forth, will be clustered around the core category of vocabulary problems.

The final step in coding the data is coding the results of the axial coding *selectively*. A *selective coding* means that coding is limited only to codes that relate to the core codes in significant ways as to be used in a parsimonious theory (Strauss, 1987:33). Aspects pertaining to conditions and strategies that have little or no relevance to the core categories are dismissed from the coding scheme. An alternative is that these aspects are noted down for the purpose of later discussion.

The following is an example of the coding processes of fractions of a participant's responses to a reading text presented. The investigation was intended to describe the strategies used in comprehending the texts written in English. The reading text is as follows:

### **Text 1**

In the beginning of the nineteenth century, the American educational system was desperately in need of reform. • Private schools existed, but only for the very rich, and there were very few public schools because of the strong sentiment that children who would grow up to be laborers should not “waste” their time on education but should

instead prepare themselves for their life's work. • It was in the face of this public sentiment that educational reformers set about their task. • Horace Mann, probably the most famous of the reformers, felt that there was no excuse in a republic for any citizen to be uneducated. • As Superintendent of Education in the state of Massachusetts from 1837 to 1848, he initiated various changes, which were soon matched in other school districts around the country. • He extended the school year from five to six months and improved the quality of teachers by instituting teacher education and raising their salaries. • Although these changes did not bring about a sudden improvement in the educational system, they at least increased public awareness as to the need for a further strengthening of the system. •

(Quoted from *Longman Preparation Course for the TOEFL*  
by Deborah Phillips, 1996, pp. 62-3)

In the *open* coding stage, all the phenomena in the data have equal opportunity to be represented by some codes despite the changes that may occur later. In the early stage of coding the following phenomena were coded as follows:

Table 1  
Example of the processes in *open coding*

Phenomena/typical exponents	Labels	Codes
I don't understand this.	Identify a problem	Idprob
What is "desperately"? I don't know this.	Question word meaning	Qwm
I don't know what is "Superintendent of Education" here.	Question phrase meaning	Qpm
"He improved the quality of teachers by instituting teacher education" What is it?	Question sentence meaning	Qsm

In the *axial* coding stage, the three phenomena labelled "questioning word meaning", "questioning phrase meaning", and "questioning sentence meaning", which were coded Qwm, Qpm and Qsm, respectively, were all considered to be exponents of the same strategy, were therefore labelled "questioning meaning", and coded Qm.

In the last stage of coding, *selective* coding, however, the researcher assumed that behind all the questioning of the meaning of words, phrases and sentences, the reader was identifying a problem. It was for this reason that the label "question meaning"

(coded Qm) was dropped, and the strategies were ultimately labelled as “Identifying a problem” and were coded “Idprob”. The process can be illustrated as follows:

Table 2  
Example of the processes in *axial coding and selective coding*

Label	Code	Label	Code	→	Label	Code
Identify a problem	Idprob	Identify a problem	Idprob	→	Identify a problem	Idprob
Question word meaning	Qwm	Question meaning	Qm	→		
Question phrase meaning	Qpm					
Question sentence meaning	Qsm					

## 6.2 Further analyses

Depending on the objectives of the research, further analyses are needed after coding has been completed. For example, in the case of the study on reading comprehension above, all the strategies used by each participant were counted to determine the frequency of their use. Percentages were used to determine the proportion of each strategy used. This way, inferences could be made about a participant's tendency in using particular strategies. An examination was also carried out to see whether the tendency of using particular strategies as reflected in the strategy patterns had any relation to the results of the comprehension measures: retelling and multiple-choice test scores, for instance.

## 7. Methods of validation

Data collection procedures should follow as closely as possible the expert recommendations by authors whose works have been cited, including Ericsson and Simon's (1993) and Pressley and Afflerbach's (1995) recommendations on collecting think-aloud data, and the researcher's own judgment based on experience and common

sense, e.g. the sequencing of methods of data collection to avoid the effects of “reactivity” (Sommer & Sommer, 1990:10; Stratman & Hamp-Lyons, 1994) in the on-line think-aloud process. As can be seen in the details of the data collection procedures above, the sequence in which the procedures are used, starts with the least and goes to the most reactive procedures, that is, starting with the one involving the least, and going to the one involving the most, intervention of the researcher

In addition, triangulations were made by (1) asking the research participants to examine the summary of the think-aloud data and make necessary adjustments to the summary and (2) asking other raters to verify (a) the whole or a sample of transcripts, (b) the whole or a sample of translation, and (c) the whole or a sample of coded protocols.

### **8. Possible influences on the study**

As can be seen from the data collection procedures mentioned earlier, think-aloud data elicitation occur in an experimental condition, in the sense that, for example, unlike in the think-aloud session, in real life natural reading, readers do not have to report what they have in mind while reading. They may, at times, vocalise their thought processes but it is for themselves and happening spontaneously. There may be a number of occasions during the data collection that may influence some of the participants’ thought processes. For example, the presence of the recording equipment itself might, to some extent, have some psychological influence on the participant. If the think-aloud session is longer than 30 or 45 minutes, replacing the tape with a new one may also halt or interfere with the participant’s thought processes. Researchers have to consider all of these potential problems. In short, efforts should be made to eliminate or to minimise possible influences on the participants’ thought processes during the think-aloud session.

### **9. Results of research studies employing think-aloud protocols**

In the field of TEFL/TESL/TESOL there have been a large number of studies, especially in reading, using think-aloud protocols as data. Among the results of these studies are as follows:



One of the most informative articles reporting a second language reading comprehension strategy research study involving think-aloud protocols is Block's (1986) article, which provides a relatively detailed description of the methodology which enables a novice researcher to replicate or conduct a similar study.

Block (1986:465-6) infers that good readers are more able to monitor their comprehension than poor readers are, that they are more aware of the strategies they use than are poor readers, and that they use strategies more flexibly. Specifically, good readers adjust their strategies to the type of the text they are reading and to the purpose for which they are reading.

Block's (1986) study identifies 15 comprehension strategies classified under "general" and "local" strategies. The general strategies include comprehension gathering and comprehension monitoring, whereas the local strategies include all attempts to understand specific linguistic units. Comprising the general strategies are anticipating content, recognising text structure, integrating information, questioning information in the text, interpreting the text, using general knowledge and association, commenting on behaviour or process, monitoring comprehension, correct behaviour, and react to the text. Included in the local strategies are paraphrasing, rereading, questioning meaning of a clause or sentence, questioning meaning of a word, and solving vocabulary problem. Upton (1997:2) calls Block's (1986) general comprehension strategies *top-down, reader-centered strategies* and local linguistic strategies *bottom-up, text-centered strategies*.

An important innovation of the coding scheme in Block's (1986) study which is not found in any other studies is the classification of readers' responses based on mode of response. Block (1986:471) defines "mode" as the way readers approach the text. The readers in Block's (1986) study used two modes of response: reflexive and intensive. In the "reflexive mode", readers relate affectively and personally, direct their attention away from the text and toward themselves, and focus on their own thoughts and feelings rather than on the information in the text. In the "extensive mode", readers attempt to

deal with the message conveyed by the author; their focus is on understanding the ideas of the author, not on relating the text to themselves.

Block (1986:473) observes that while the general strategies occurred in both the extensive and reflexive modes, all local strategies occurred in the extensive mode. Block (1986:482) notes that one group of readers, the integrators, responded only in the extensive mode. These integrators were aware of text structure with relative frequency, and monitored their understanding consistently and effectively. Although they sometimes related the text to their own lives, they consistently anchored these associations to the information in the text. This is consistent with the suggestion that good readers are those who manage to keep a balance between the two sources of information: information within the text and that outside the text, i.e. background knowledge and experience needed to interpret the information found in the text (Fyfe & Mitchell, 1985; Meyer and Keefe, 1990). Block (1986:483) points out that when the integrators did not understand, they frequently read on, looking for clues. More importantly, readers who used the strategy of integration were actually performing two acts, not one. They were retaining information and applying it to newly learned information (Block, 1986:487).

The second group of readers, the non-integrators, seemed to rely much more on their personal experiences to help them develop a version of the text. As a group, their responses were more often in the reflexive mode. They made fewer attempts to connect information and tended to refer to personal experiences more than the integrators. Although their associations with their own lives were initiated by information in the text, non-integrators usually failed to reconnect these associations with the information in the text. Thus, these associations became ends in themselves, rather than a means for extending and explaining the text (Block, 1986:486).

A number of participants of Block's (1986) study commented on how much they had learned about how to read better through their participation in the study. These responses suggest that think-alouds are an important learning tool. The task of thinking aloud appeared to focus these readers' attention on what they understood and what they needed to know (Block, 1986:487). Awareness of what they were doing and what they

understood allowed some of them to teach themselves. Therefore, teachers can encourage this approach in their classrooms in several ways. For example, they might ask learners to talk to each other about what they do and do not understand as they read. These paired readers could then share problems, knowledge, and strategic resources (Block, 1986:488).

In a later article, Block (1992) suggests that metacognitive control, a globally oriented process, distinguishes readers' proficiency. Block (1992:322) infers that meaning-oriented readers can overcome the effects of limited language proficiency and readers with greater L2 proficiency (ESL readers) favoured a global process, whereas those with less L2 familiarity (EFL readers) used a more localised process, a process negatively correlated with reading performance. The more proficient readers seemed to have a more meaning-based approach and did not worry about the meaning of words if they could extract the gist of the sentence (Block, 1992:334).

Block (1992:337) suggests that the proficient readers in her study did not expect to understand everything as they read. Part of the strength of their reading was in being able to decide which problems they could ignore and which they had to solve. They were prepared to monitor their understanding and question what they understood. She points out that questioning and monitoring is a part of good reading, not the result of imperfect knowledge of their target language.

Sugirin's (1995) study, which attempted to partially replicate Block's (1986) study, revealed that inferring, reading the text aloud, paraphrasing, and making associations and use of general knowledge were the four strategies most often employed among nineteen strategies used by the participants of his study. In solving comprehension problems, two readers used global strategies relatively successfully, while the others often used local linguistic strategies unsuccessfully. The more successful readers in the study employed more varied strategies than the less successful ones. The study indicates that the use of challenging reading texts seemed to have caused the readers to concentrate on comprehending the texts rather than on reporting what they were thinking while reading. The readers who had problems comprehending texts, but were aware of the problems and tried to overcome the problems, provided substantial

information reflecting their comprehension strategies. This suggests that, in order to generate reports on readers' thought processes, an appropriate level of difficulty of texts used in think-aloud protocols must be considered.

### **10. Implication for classroom practice and suggestion for teachers and researchers**

As Block (1986:488) suggests, teachers can encourage learners to talk to each other about what they do and do not understand as they are working on a task. These learners can then share problems, knowledge, and strategies in solving the problems. By observing their problem-solving process, teachers can identify the learners' strengths and weaknesses so that ways can be devised to help them improve their learning strategies (e.g. making those who are always concerned with difficult words aware that in order to comprehend a text one does not need to understand the meaning of every word used in the text). Then these teachers can design a new program, or revise the implementation of the existing program, to meet the real needs of the learners.

With the potentials of think-aloud protocol analysis in process studies, TEFLIN researchers are expected to pay balanced attention to both product and process in their attempts to learn more about the learners for the purpose of empowering them.

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