THE THINK ALOUD METHOD: SOME CONCERNS ADDRESSED

Vijay Kumar
University of Otago
New Zealand

Abstract

This paper will first discuss the theoretical underpinning of the Think Aloud Method. Secondly, it will relate the TA method to the working memory by considering writing as a problem solving activity. Finally, it will discuss some theoretical and methodological concerns of using this method and how these were addressed in a study*

Introduction

Writers often lament that the process of writing is complicated and difficult to understand (Torrance & Jeffery, 1999) Perhaps not coincidentally, it has been suggested that writing is one of the least understood and the most difficult cognitive tasks (Ransdell & Levy, 1999). One step towards understanding writing and its complex problem solving processes lies in a detailed and fine-graded analysis of its components. Case studies using the Think Aloud (TA) method provide this opportunity to probe individual cognitive processes. In fact, the TA method has provided the bulk of research on writing process studies, and constitute the main sources of data about writing over the last

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two decades (Owens & Newell, 1994, Ransdell, 1995, Sasaki, 2002). Even though this method has been widely used, some of its theoretical and methodological foundation has been criticised.

This paper will first discuss the theoretical underpinning of the TA Method. Secondly, it will relate the TA method to the working memory by considering writing as a problem solving activity. Finally, it will discuss some theoretical and methodological concerns of using this method and how these were addressed in a study.

The Think aloud method

The TA method relies on verbal think-aloud protocols as data. In this method, participants are asked to verbalize their thoughts continuously while performing a task and these verbalizations are audio-taped. The protocols, defined as "description of activities, ordered in time, which a subject engages in while performing a task" (Hayes & Flower, 1980:4) are then transcribed, broken into protocol segments and analysed using a

A lot of what happens during the TA entails the use of the participant's Short Term Memory (STM). It has been suggested that the STM represents a set of interacting subsystems that together are referred to as the 'working memory' (Baddeley, 1986). The Working Memory (WM) can be understood by this example. When we think of something to write, we try to write it down quickly If our computer or a paper is not available, we hold on to these ideas until we get to one. The ideas are held in temporary memory resources. These temporary resources are called the WM. The WM is the system responsible for processing and storing information on a short-term basis (Levy & Ransdell, 1996; McCutchen, 1996) According to Baddeley (1986), the main component of the working memory is the central executive (CE). In terms of writing, it is assumed that processes such as "planning, translating, reading and editing presumably make demands on the central executive" (Kellogg, 1996:67). The CE co-ordinates, processes and integrates information activities within the working memory by regulating information flow. The short term *store* holds information temporarily when the CE decides on the next course of action by retrieving information from other memory systems (sensory memory and long term memory). The efficiency of the CE in terms of processing information depends on the number of demands placed on it. It has been suggested that the working memory is able to process stored information faster (Kellogg, 2001).

A second component of the memory system is the Long Term Memory (LTM). It has been suggested that the LTM has its own working memory (Ericsson & Delaney, 1999; Ericsson & Kintsch, 1995) The Long Term

Working Memory (LT-WM) has been proposed to explain processing fluency (Ransdell, Arecco, & Levy, 2001) and efficient retrieval of domain-specific knowledge (Ericsson & Delaney, 1999). In terms of writing, this means that skilled writers who have a store of knowledge (writing processes, topic, genre, audience, conventions, etc), will have instant access to relevant information in the LTM. Thus, it is suggested that skilled writers "move beyond the limits of the Short Term Working Memory and capitalise on the resources of the LT-WM" (McCutchen, 2000) to solve writing problems".

It is the working of these memory systems that researchers are trying to tap in order to understand the cognitive processes. The information processing model (Ericsson & Simon, 1993) is said to provide a theoretical basis for understanding the workings of these memory systems. The model suggests that verbal think aloud reports trace these cognitive process and provide "the closest reflection of the cognitive process" (Ericsson & Simon, 1993 16) during problem solving tasks.

Writing has been considered a problem solving task (Flower & Hayes, 1980) as writers are confronted with numerous decisions when they write. They have to decide on their purpose of writing, tone, choice of language, formulation of ideas, sentences, phrases and how to translate all these into written form. The Individual –Environment Model of writing (Hayes, 1996) suggests that decisions on writing are influenced by the social/physical environment. In other words, the audience and the composing medium are crucial components of the decision making process and this is influenced by motivation. All these considerations which can be seen as processes, do not occur in a linear pattern but are recursive in nature. According to this model, during these recursive processes, the writer may listen to 'voices' (metacommentary) with their suggestions, rules and advice. These 'voices' may orchestrate the writing. Some of these voices would be about past writing experiences and would perhaps include images of a teacher telling the writer to "write an outline first, check your grammar". The writer is confronted with many decisions to make or "writing problems". Among the problems are how to deal with these 'voices', a perceived audience, expectations of a genre, language and grammar. Besides this, writers have to work through their own ideas by moving forth and back to address these 'voices' and concerns. These recursive processes are described by as "the act(s) of juggling a number of simultaneous constraints" (Flower & Hayes, 1980:31). These 'jugglings' place a lot of demands on the memory. The memory systems come into play during the writing process. The Short Term Working Memory plans, organises and sets writing goals. The LTM provides task schemes, audience knowledge, linguistics knowledge and genre knowledge to help the writer meet these goals. Protocols are assumed to have the "capacity of telling stories {that} trace

these mental activities and provide a unique glimpse of the workings of the human mind" (Smagorinsky, 1994:xiii) It is because of this strength that the TA method is used to understand cognitive processes during the act of writing.

Think aloud protocols about writing are usually collected by two types of verbalizations: retrospective reports and concurrent verbalizations.

Retrospective Protocols

The first type of verbalization procedure is the retrospective think aloud method. In this method, participants are asked to explain and describe their cognitive processes after the primary task of writing has been carried out. The validity of the information procured using retrospective verbalizations depends on whether the reports are asked immediately after a specific task or after a lapse of time. If participants are requested for immediate feedback, they may be able to fall back on their STM and provide information which is stored in the short term store (Ericsson & Simon, 1993). Delayed retrospection may result in the *Zeignarnik* effect, that is, participants forget goals once they have been accomplished. Whether the retrospective report is requested immediately, or after a lapse of time, there is "a tendency for writers to include their own prefabricated theories about the process" (Ransdell, 1995:90) This is because participants will rely on the Long Term Memory to search for relevant information before transferring them to the STM for verbalization (Matsumoto, 1994). During the process of transferring, unrelated information from the LTM may also be reported. Participants may also try to "tidy up what happened ... to rationalise what occurred" (Green, 1995 128) to impress the researcher. When all these happens, what the researcher gets may be accounts of "reconstructive processes" (Leow & Morgan-Short, 2004), that is, verbalizations based on previously acquired information stored in the LTM. As this is suggested to "confound the concurrent trace of their thought processes" (Ericsson, personal communication), retrospective reports are not valid insights into cognitive processes that were heeded to by the STM during the writing task.

Concurrent protocols

A second type of verbalisation procedure is called concurrent verbalisation (CV). This type of verbalisation addresses some of the drawbacks of the retrospective procedure. In the CV method, participants say out loud everything that they are thinking while writing. In other words, they are required to verbalize the sequence of events that enter their attention while performing a

task. This is different from the retrospective method in the sense that concurrent verbalizations focus on the "decision-making processes, whereas retrospective protocols focus on decision outcomes" (Kuusela & Paul, 2000:400). In the CV method, the researcher is interested in looking at these decision making processes, as it may be able to "reveal the sequence of information heeded" (Ericsson & Simon, 1993.31). Among the heeded information would be problem solving processes of writing such as planning, monitoring, reviewing, setting goals, listening to voices and numerous other considerations. These decision making processes can be audio-taped, thus paving the way for analysing and tracing the decision making processes and patterns. Since concurrent verbalisations are collected during the performance of the writing task, participants are able to recall the information and provide direct verbalizations which "closely match the flow of attention to information" (Green, 1995 128). An added forte of the CV is that "no thought, feeling, or action would be omitted" (Robinson, 2001:211) because processing and verbalization occur simultaneously.

The CV method provides a more reliable route into the mental activities during revision. The next section discusses some of the theoretical and methodological concerns of using the CV think aloud method and how these were resolved in this study.

Theoretical concerns

Since cognitive processing is a silent activity, verbalizing this private activity is accused of changing the natural thought processes by compromising on the validity of the verbal data (Wilson & Schooler, 1991). As such, the interpretation of these data raises two theoretical concerns known as reactivity and veridicality

(1) Reactivity

One of the major theoretical concerns of using the TA method is that it is reactive. Reactivity is said to take place if the thinking and decision making processes are changed or a longer duration of time is taken to perform a task (Russo, Johnson, & Stephens, 1989). While thinking aloud, participants are required to do two things – first perform a primary task, that is writing and secondly they have to think aloud (secondary task). It has been suggested that the primary task may be compromised because it necessitates the additional task of verbalizations (Schooler, Ohlsson, & Brooks, 1993). This is based on the claim that some of the cognitive resources available may have to be utilized to perform both the primary task and the secondary task. Thus, the thinking

process could be slowed down to accommodate additional cognitive demands of verbalizations. The artificial nature of requiring the writer to talk aloud while composing is unlike normal writing circumstances and is thus, accused of not providing an accurate view of the composing process (Dobrin, 1986; Smagorinsky, 1989).

However, these claims, that the think aloud method has an effect on the final written product, have been empirically refuted. One of the first studies to test for reactivity in writing was done by Stratman & Lyons (1994). In their study, twelve participants were asked to revise a faulty text by contrasting the TA and non TA method. All twelve students had to revise two isomorphic faulty texts. The first task required students to perform the task using the TA method half of the time and in the second half of the time they performed in the non-TA method. After a lapse of eight weeks, the second task was administered to the same twelve students and the TA/non-TA conditions were reversed. The measure of error detection/removal, content changes and structural changes (meaning changes) enabled the researcher to suggest, "at most, the TA condition merely reduces the amount of certain kinds of verbal processing, without fundamentally altering the nature of the process" (p. 108).

In another study, Ransdell (1995) required all her thirty-eight participants to compose a letter (narrative about: *First day in college*) on computer for twelve minutes each under the following three conditions. a concurrent thinking-aloud protocol, a retrospective protocol based on watching a real-time replay of the original composition and a no-protocol control. An empirical measurement of the rate of word and clauses used per minute confirmed that "thinking aloud slowed down the rate of composition, but did not reliably alter the syntactic complexity or quantity of words or clauses written" (p. 89).

Another comprehensive study (Levy & Ransdell, 1995) investigated the impact of CV protocols on the writing processes (time on task and effort data) and the written texts. This study involved ten undergraduate students having to write several compositions in 40 minutes over a period of twelve weeks. After five weeks, the students were trained in the CV method and from then on, they had to write using the TA method. Their analysis of planning, text generation, revising/reviewing and the written text (scored on 13 dimensions of writing quality including overall quality, content, purpose, style, word choice, organizational and mechanics) indicates that the effect of TA was negligible and that "writers are not adversely affected by generating verbal protocols" (p.776).

Similarly, a pause analysis study to investigate reactivity of TA on the writing process was carried out. In their first experiment (Janssen, van Waes, & den Bergh, 1996), twenty students wrote two business letters. The task required the writers to address scholarship and credit card problems. The

second experiment required the students to describe Dutch customs/events. The same students had to write in both TA and silent condition for both the tasks. A Keystrap computer software registered their activities providing indirect observation of the pauses during the writing process. The conclusion from this study was that TA was reactive in both experiments as the processes were slowed down. Even though this was the case, it has been suggested that processing rate does not affect the nature of these processes (Ransdell, 1995).

The general conclusion from these empirical studies on reactivity is that verbal protocols slows down the writing but "slowing of writing rate is at best transitory; writers are soon able to write efficiently even while generating protocols at the same time"(Levy & Ransdell, 1995:776). It seems justifiable to presume that processing time is slowed down because the working memory has to attend to two major demanding tasks, writing and thinking aloud. As a result of this, "additional time is required for verbalization of the heeded thought" (Ericsson & Simon, 1987.51). Thus, reactivity is not a limitation when using this method to study writing.

(2) Veridicality

A second theoretical concern of using the TA is the veridicality of the verbal reports. Veridicality refers to "the extent to which introspection is accurate or truthful or the degree to which .. (verbalizations) represent their actual cognitive process" (Matsumoto, 1994:379). Veridicality thus raises two concerns. validity and completeness of the verbal reports. The premise for this concern is that cognitive processes involve both conscious and unconscious processing. Since verbal reports are said to provide data only on normal conscious processing and not on the underlying processes (unconscious) of a given task, the validity of the data gathered and the verification of the mental processes using this method becomes questionable (Nisbett & Wilson, 1997). Since unconscious processing also takes place together with conscious processing. and only conscious processing is collected as data, the final data is accused to be incomplete (Beach, 1976; Belinger, Whitaker, Feng, Swanson, & Robert, 1996; Cooper & Holzman, 1983) There are suggestions that incompleteness of data gathered due to the absence of unconscious data "does not invalidate the information [conscious data] which is present" (Ericsson & Simon, 1993:243). Similarly, there are also suggestions that even though the verbal reports may be incomplete. "what remains to be reported will not invalidate what has been reported" (Matsumoto, 1994:377). The basis for such a claim is that verbal reports based on conscious processing still contain useful information about cognitive processes. Even though incompleteness of

verbal reports could be a limitation, the concurrent think aloud method provides an immediate route into the verbal consciousness of the writer.

Based on these discussions, it would seem that the theoretical concerns have been refuted by empirical evidence which suggest that reactivity and veridicality do not affect the validity of the TA method. However, there are some methodological concerns that need to be addressed.

The next section of this paper will discuss some methodological concerns of using the think aloud method.

Methodological concerns

Besides reactivity and veridicality, the TA Method raises a number of methodological concerns. These concerns include selection of participants, warm up sessions, observer effects and the choice of topics.

(1) Selection of participants

The first methodological concern is the selection of participants for think aloud studies. This is because some participants may be able to write well but not verbalize. Others may be able to generate a lot of verbal data but may not produce sufficient written text. Verbalisation while performing a task does not come easily to anyone as it requires practice. Some previous studies have not looked at this aspect and selected participants based on achievement tests (Emig, 1971, Stallard, 1974). In one study for example, participation was made "a part of a course requirement" (Ransdell, 1995:92). There could have been instances where some participants may not have been able to provide rich data and this could have led to a certain degree of unreliability in the interpretations of the data.

In the present study, the above problems were addressed by getting a pool of volunteers who met the criteria of the study, that is, they were Malaysian native speakers of English. Secondly, only four volunteers who provided rich verbalizations during the warm up sessions were selected. This is in line with grounded theory which suggests that sampling should be "intentional and focused" (Creswell, 2002:450).

(2) Warm up sessions

A second methodological concern of using the TA method is the warm up sessions. Participants of the TA method are given ample time to practice on sample tasks to ease their initial reservation and feel comfortable composing aloud. These warm up sessions (Ericsson & Simon, 1993, Kormos, 1998)

have been accused of influencing the final outcome of studies. However, these warm up sessions are not intended to familiarize participants with the writing process as participants will have "no knowledge of [the] specific research purpose" (Matsumoto, 1994:371).

In this study, demonstrations and practice sessions were done to enable the participants to see how composing aloud is done and to help them become comfortable with verbalizing their thoughts. Among some activities done during the warm up sessions included asking participants to think aloud while solving mathematical problems such as "what is 48 x 54" These warm up activities did not demonstrate the revision strategies to the participants.

(3) Observer effect

A third methodological concern is the presence of the researcher. In previous studies (Emig, 1971, Stallard, 1974) which used the observation method, the researcher sat in front of the writers. Tone of voice requesting the writer to keep on talking, the age and gender of the researcher and perhaps gestures may have influenced the data (Smagorinsky, 1994). One of the reasons why the researcher was present in these studies was to remind the participants to "keep on talking" when there was a long period of silence. Since the participants may feel self-conscious of their writing, the researcher's presence may have a negative effect on the verbalisations and participants may produce socially acceptable data (Cohen, 1987). Thus, their verbalizations may not be an actual representation of their natural thought processes (Ericsson & Simon, 1993).

To address this drawback, the participants of this study were requested to do the recording on their own. Once the researcher was confident that the primary task of writing would be adhered to, they were issued portable tape recorders so that they "could write and think aloud whenever/wherever they had the opportunity" (Smagorinsky, 1994.14), thus allowing writing to take place in a natural writing environment.

(4) Choice of topics

A final methodological concern in a TA study is the choice of topics. This is important as what the researcher is trying to do is to identify cognitive processes which the students use when they solve writing problems. Studies using the TA method have concentrated on narratives and expositions (Butterfield, Hacker, & Plumb, 1994, Piolat, 1991; Ransdell & Levy, 1994). Among the reasons cited for using narratives is "even the least skilled writers would be able to draw on their own life experience" (Pennington & So, 1991:48).

However, participants of some studies have been claimed not to be "overtly overtaxed" (Ransdell, 1995:96) by narrative tasks. This was probably because participants could be retrieving ideas from memory and hardly thinking through the process. This view is supported in a study where narratives on Dutch culture and events were considered less demanding (Janssen et al., 1996). The researchers reasoned that the writers could have resorted to their LTM without any additional problem solving when performing narrative tasks. In the same study, participants who wrote business letters were claimed to be performing a demanding task because they could not rely on their Long Term Memory for "ready made plans and discourse models"(p.24). Flower (personal communication), sums this up by asserting that "narrative writing doesn't give much on a protocol tape because people are not thinking about other concerns"

A second contention about choice of topics is that previous studies did not report doing any checks to see if the students had written on these topics before. Narratives such as, *First days of college* (Ransdell, 1995), *Saddest day in my life* (Pennington & So, 1993) are very common college/school sponsored topics. These topics may have been written or spoken about previously; consequently, what the writer does is narrate from memory. Thus, the working memory is not constrained during narrative writing; as a result the researcher does not get to see much of the problem solving processes predicted by the Information Processing Model proposed by Ericsson and Simon (1980).

Since argumentative topics are assumed to be more demanding and thus promote more problem solving activities insights into the cognitive jugglings, an argumentative topic was chosen for this study. The participants confirmed that they had not written about this topic previously.

Conclusion

The above discussion has acknowledged some limitations of and concerns about the TA method and how they were addressed in my study. The discussions also offered empirical data to refute claims of reactivity and veridicality. This included giving appropriate information, collecting protocols during the task performance, minimum intervention by the researcher, selecting participants based on richness of verbalizations, and choosing writing tasks that stimulated cognitive processes. The discussion also affirms that verbal protocols do allow the researcher "to listen carefully, to see into the heart of the matter, and to tell the story simply and (as) accurately as possible" (Dobrin, 1994:289).

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