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The relationship between reading comprehension and critical thinking: A theoretical study

Abdulmohsen S. Aloqaili

King Saud University, College of Education, Department of Curriculum and Instruction, Saudi Arabia

Abstract   The main purpose of the present study is to review and analyze the relationship between reading comprehension and critical thinking. The specific theatrical issues being discussed include schema theory as a rational premise for the connection between reading comprehension and critical thinking, cognitive development processes, critical thinking: its nature and definitions, critical thinking: skills and dispositions, and critical thinking and reading comprehension. The results revealed that: (1) there is well established relationship between reading comprehension and critical thinking, (2) schema theory provides a rational premise for that relation, and (3) there is no consensus regarding the definition of critical thinking which might be interpreted as a lack of an accepted framework for critical thinking.

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1. Introduction

In recent years, the field of research on reading comprehension and critical thinking has received much attention and became a popular area in cognitive psychology. Modern cognitivists have developed new trends and theories that provide theoretical models for explaining and conceptualizing reading comprehension by utilizing a set of related concepts, such as critical

E-mail address: aloqaili@ksu.edu.sa

thinking, prior knowledge, inference-making, and metacognitive skills (Limbach and Waugh, 2010; Zabit, 2010). Among these trends is schema theory, which is considered to be a theory about knowledge: how knowledge is represented and organized, and how that representation and organization facilitates the use of a reader's prior knowledge to improve reading comprehension. A schema is the organized knowledge that one has about people, objects, places, events, processes, concepts, and virtually everything that provides a basis for learning (Rumelhart, 1984). Bos and Anders (1990) stated that, "Schema theory explains how knowledge is structured in memory and how these structures affect incoming information" (p. 49). Anderson and Wilson (1986) indicated that schema theory explains how people's existing knowledge affects comprehension.

Critical thinking can be considered as means to activate or construct schema. Norris and Phillips (1987) indicate that critical thinking provides an explanation for activating existing schemata and for constructing new ones by contrasting ideas and engaging in reflective thinking. Moreover, Collins et al.

(1980) count inference-making as a way to activate schemata in terms of filling in the missing connections between the surface structure fragments of the text by recourse to content and knowledge about the world.

McNeil (1992) asserts that schema theory has special relevance for teachers of reading comprehension in that it questions the traditional view that students should learn to reproduce the statements being read in the text. In contrast to this older view of reading comprehension, schema theory stresses an interactive approach that views teaching reading comprehension as a process, meaning that students are taught techniques for processing text, such as making inference, activating prior knowledge, and using critical thinking (McNeil, 1992; Aloqaili, 2005a; Orbea and Villabeitia, 2010).

Tierney and Pearson (1986) explain that schema theory has the major influence on new views of reading and reading comprehension. They stated that:

> New views have forced us to rethink the act of reading. For a long time we thought reading was the reproduction of the ideas on the page; our goal was to have students produce a ''photocopy'' of the page. Schema theory has moved us away from a reproductive view to a constructive view. In that view, the reader, rather than the text moves to the center of the construction process (p. 3).

According to schema theory, there are no definitive or final conclusions that can be reached for the text (Norris and Phillips, 1987; Yu-hui et al., 2010). That is, schema theory deals with the reading comprehension as an interactive process between readers' prior knowledge and the text being read. Sometimes a reader may end up with a different understanding, based on his or her total previous experiences: their richness or paucity. Therefore a reader with a rich background will comprehend better than one who has a poorer background. In short, schema theory believes in open text or context. The interpretation is relative (Aloqaili, 2005b). For the purpose of the study, reading comprehension can be defined as the meaning constructed as a result of the complex and interactive processes relating a reader's critical thinking, prior knowledge, and inference-making.

2. Cognitive development processes

Piaget (1952) presented three cognitive processes which he used to explain how and why cognitive/concept development occurs. These processes are assimilation, accommodation, and equilibrium. Marshall (1995) believes that Piaget made a key contribution to schema theory with his focus on how schemata develop and change. So, the following section will be devoted to a brief explanation of Piaget's work related to cognitive development processes.

Piaget (1970) proposed that cognitive growth occurs when the learner establishes mental categories (schemata) comprised of concepts about subjects and events sharing some general or specific features. He views schemata as cognitive structures by which individuals intellectually adapt to and organize the environment.

Piaget (1952) provides three cognitive mechanisms which interpret how children develop, acquire, classify, or organize their schemata or cognitive structures. These cognitive processes or mechanisms are assimilation, accommodation, and equilibration.

2.1. Assimilation

According to Piaget (1952) assimilation is a continuous process that helps the individual to integrate new, incoming stimuli into the existing schemata or concepts. That is, assimilation includes adding new information to old schemata. To illustrate the assimilation processes, Rubin (1997) presents an example of young children who tend to classify all similar four-footed animals as dogs; the children are assimilating. What they do is that they have assimilated all four-food animals into their existing schemata.

Wadsworth (1996) points out that the assimilation process elaborates the size or growth of schemata, however, it does not alter them, and it is simply like adding air into a balloon. He stated the following:

> Assimilation theoretically does not result in a change of schemata, but it does affect the growth of schemata and is thus a part of development. One might compare a schema to a balloon and assimilation to putting more air in the balloon. The balloon gets larger (assimilation growth), but it does not change its shape. Assimilation is a part of the process by which the individual cognitively adapts to and organizes the environment'' (p. 17).

Thus, assimilation allows for the growth of schemata by adding or taking in new information to old. However, the assimilation process does not change or create new schemata. Change and creation of schemata are the functions of another cognitive development process, which is accommodation.

2.2. Accommodation

Piaget (1952) indicates that accommodation is the process of developing new categories by a child rather than integrating them into existing ones. That is, accommodation is the way by which children create new schemata or change old ones with new information. Wadsworth (1996) explains that if the child meets with new stimulus that cannot be assimilated because there are no schemata into which the stimulus would fit, the alternative is either to construct new schemata in which to place the stimulus (a new index card in the file), or change or modify the existing ones to fit with new stimulus. That is, accommodation has two aspects or forms: creation of new schemata or modification of old schemata with new ones.

Wadsworth (1996) clarifies the difference between assimilation and accommodation by stating that ''accommodation accounts for development (a qualitative change) and assimilation accounts for growth (a quantitative change; together these processes account for intellectual adaptation and the development of intellectual structures'' (p. 19).

Rubin (1997) asserts that in spite of the importance of both assimilation and accommodation as a cognitive process development, children should be aware of making a balance between these two processes. Therefore, balancing between assimilation and accommodation is the function of the third cognitive mechanism, which is equilibrium. A brief explanation of equilibrium is provided below.

2.3. Equilibrium

According to Piaget (1952) equilibrium is a balance between the assimilation and accommodation processes. Wadsworth

(1996) indicates that if a child overassimilates, he or she will end up with a few too large schemata, and will be unable to find out the differences in things, because most things seem similar to him or her. In contrast, if a child overaccommodates, he or she will have too many small schemata. This over-accommodation would prevent him or her from detecting similarities, because all things seem different to him or her.

Rubin (1997) explains that a child with equilibrium process would be able to see similarities between stimuli and thus assimilate them, and also would be able to determine when new schemata are needed for adequate accommodation of a surplus of categories or schemata.

3. Critical thinking: its nature and definitions

The literature indicates that there is no consensus regarding the definition of critical thinking. A multiplicity and variation of definitions of critical thinking are reflective of the way in which educators and scholars define it (Aloqaili, 2001; Minter, 2010). Romeo (2010) explains that there is currently a lack of an accepted framework for critical thinking, so that there is not a widely acknowledged and accepted theoretical definition. Some educators and psychologists deal with critical thinking as a narrow concept, whereas others view critical thinking as a broad concept. For example, Beyer (1987) defined critical thinking in a narrow sense as convergent thinking. He stated clearly that "critical thinking is convergent" (p. 35), in contrast to creative thinking which is divergent.

Beyer (1985) has argued that "critical thinking is not a process at least not in the sense that problem solving or decision making are processes; that is, critical thinking is not a unified operation consisting of a number of operations through which one proceeds in sequence" (p. 303).

Mcpeck (1981) has offered this broad definition for critical thinking, "The propensity and skill to engage in an activity with reflective skepticism" (p. 8). Ennis (1993) criticizes Mcpeck's definition because it focuses on "reflective skepticism," and according to Ennis, "critical thinking must get beyond skepticism" (p. 180). Ennis (1962) has dealt with critical thinking with a narrow sense. He stated that critical thinking is "the correct assessing of statements" (p. 6). However, Ennis (1985) has replaced his narrower definition with the broader one which viewed critical thinking as "reasonable, reflective thinking that is focused on deciding what to believe or do" (p. 46).

One of the main differences between Ennis' definitions of critical thinking is that the broader definition includes creative elements, but the narrower one tried to exclude them. Ennis (1987) explains and analyzes his broader definition of critical thinking as follows:

Critical thinking, as I think the term is generally used, is a practical reflective activity that has reasonable belief or action as its goal. There are five key ideas here: practical, reflective, reasonable, belief, and action. They combine into the following working definition: Critical thinking is reasonable reflective thinking that is focused on deciding what to believe or do. Note that this definition does not exclude creative thinking. Formulating hypotheses, alternative ways of viewing a problem, questions, possible solutions, and plans for investigating something are creative acts that come under this definition (p. 10).

Lewis and Smith (1993) indicate that although Ennis does not use the term problem solving in his definition of critical thinking, he refers to the usual steps in problem solving as creative acts which are a part of his definition. In other words, Ennis separates critical thinking and problem solving while pointing out their interdependence in practice.

Ennis (1987) explains that he abandoned his narrower definition of critical thinking "because, although it provides more elegance in theorizing, it does not seem to be in accord with current usage" (p. 11). Kennedy et al. (1991) point out that current usage of the term "critical thinking" generally reflects Ennis' broad definition.

According to Ennis (1993), for a person to reasonably and reflectively go about deciding what to believe or do, most of the following things characteristically must be done interdependently:

Judge the credibility of sources.
Identify conclusions, reasons, and assumptions.
Judge the quality of an argument, including the acceptability of its reasons, assumptions, and evidence.
Develop and defend a position on an issue.
Ask appropriate clarifying questions.
Plan experiments and judge experimental designs.
Define terms in a way appropriate for the context.
Be open-minded.
Try to be well informed.
Draw conclusions when warranted, but with caution.

Another scholar who has provided a broad definition for critical thinking is Facione (1984) who developed a definition of critical thinking that incorporates evaluation and problem solving. Facione indicates that it is possible to evaluate critical thinking by evaluating the adequacy of the arguments that express that thinking. He stated that "critical thinking is the development and evaluation of arguments" (p. 259).

Lewis and Smith (1993) point out that what is new in Facione's definition is that he views critical thinking as an active process which involves constructing arguments, not just evaluating them. According to Facione (1984) constructing arguments include the usual steps of problem solving which are: (1) determining background knowledge, (2) generating initially plausible hypotheses, (3) developing procedures to test these hypotheses, (4) articulating an argument from the results of these testing procedures, (5) evaluating the arguments, and (6), where appropriate, revising the initial hypotheses.

Facione (1984) stated that "Learning argument construction means learning the methodologies that generations of researchers have refined for the specific needs of each discipline" (p. 259). In this study, critical thinking refers to the process by which the reader thinks reasonably and reflectively for the purpose of meaning construction.

4. Critical thinking: skills and dispositions

There is an argument between educators regarding whether critical thinking involves both skills and dispositions. If so, which skills and which dispositions? Skills (or abilities) are the more cognitive aspect of critical thinking, however, dispositions (or attitudes) are the more affective aspect.

Beyer (1984) views critical thinking as a set of nine discrete skills, including: (1) distinguishing between verifiable facts and value claims, (2) determining the reliability of a source, (3) determining the factual accuracy of a statement, (4) distinguishing relevant from irrelevant information, claims or reasons, (5) detecting bias, (6) identifying ambiguous or equivocal claims or arguments, (7) recognizing logical inconsistencies or fallacies in a line of reasoning, (8) distinguishing between warranted or unwarranted claims, and (9) determining the strength of an argument.

A number of researchers in critical thinking disagree that critical thinking is only a set of skills, and they maintain that critical thinking also involves dispositions. So in the literature the importance of dispositions has been heavily stressed (Ennis, 1987; Norris, 1985; Baum and Newbill, 2010; Facione, 2010; Zori et al., 2010; Sternberg, 1985).

Paul (1984) makes a useful distinction regarding the dispositions of the thinker. He deals with critical thinking in two different ways: critical thinking in the weak sense and critical thinking in the strong sense. He asserts:

> In a weak sense, critical thinking skills are understood as a set of discrete micrological skills ultimately extrinsic to the character of the person; skills that can be tacked onto other learning. In the strong sense, critical thinking skills are understood as a set of integrated macro-logical skills ultimately intrinsic to the character of the person and to insight into one's own cognitive and affective processes (p. 5).

Paul (1991) indicates that critical thinking in the strong sense involves approaching issues from multiple perspectives and demands open-mindedness to understanding points of view with which one disagrees.

Among those who advocated skills and dispositions were Ennis (1985), who defined critical thinking as "reasonable, reflective thinking that is focused on deciding what to believe or do" (p. 46). Based on his broad and working definition of critical thinking, Ennis (1987) developed a taxonomy of critical thinking skills which includes thirteen dispositions and twelve abilities that together make up critical thinking. For example, some of the dispositions of a critical thinker, as mentioned by Ennis (1987) are:

(1) Seek a clear statement of the thesis or question.
(2) Take into account the total situation.
(3) Keep in mind the original and/or basic concern.
(4) Look for alternatives.
(5) Use one's critical thinking abilities.
(6) Be sensitive to the feelings, level of knowledge, and degree of sophistication of others.
(7) Be open-minded.

In addition to these dispositions, there are some abilities, such as: (1) focusing on a question, (2) analyzing arguments, (3) asking and answering questions of clarification and/or challenge, (4) judging the credibility of a source, (5) deducing and judging deductions, (6) inferring explanatory conclusions and hypotheses, and (7) identifying assumptions. Each of these abilities contains a large number of sub-abilities (Ennis, 1987).

5. Critical thinking and reading comprehension

The relationship between critical thinking and reading is well established in the literature. For example, Norris and Phillips (1987) point out that reading is more than just saying what is on the page; it is thinking. Moreover, Beck (1989) asserts "there is no reading without reasoning" (p. 677). Also, among those researchers and theoreticians who recognize that reading involves thinking is Ruggiero (1984). He indicates that reading is reasoning. Yu-hui et al. (2010) stated clearly that reading is a thinking process to construct meaning.

Utilizing and combining schema theory with principles of critical thinking are one of the effective ways of enhancing the concept of reading comprehension (Norris and Phillips, 1987). They explain that critical thinking provides a means of explaining the ability to work out ambiguous text by generating alternative interpretations, considering them in light of experience and world knowledge, suspending decision until further information is available, and accepting alternative explanations. They conclude that critical thinking is the process which the reader uses to comprehend.

Schema theory provides powerful rationales for making links between students' individual backgrounds, specific subject area knowledge, and critical thinking (Marzano et al., 1988; Aloqaili, 2005c). According to Anderson (1994), there are six ways in which schemata function in thinking and in remembering text information. These six ways are:

(1) Most new knowledge is gained by assimilating new information into existing structure; therefore, subject matter learning should build on prior knowledge whenever possible.
(2) The students' existing schemata help to allocate attention by focusing on what is pertinent and important in newly presented materials.
(3) Schemata allow and direct the inferential elaboration of incoming information and experience.
(4) Schemata allow orderly searches of memory by providing learners with a guide to the types of information that should be recalled.
(5) Schemata facilitate the thinking skills of summarizing and editing.
(6) Schemata permit inferential reconstruction when there are gaps in memory, which means that they help the learner generate hypotheses about missing information.

It is obvious, based on the previous six schemata functions, that prior knowledge plays a significant role regarding establishing connections between thinking critically and processing text information. This connection consequently leads the readers to reach the critical comprehension level.

In accordance with this notion (the relationship between prior knowledge and critical thinking), the literature reveals an agreement between researchers concerning the idea that an individual's familiarity with the subject matter of a text plays an important part in the person's performance on thinking tasks in that area (Glaser, 1984; Norris, 1985; Sternberg and Baron, 1985). Knowledge and thinking skills can be viewed as interdependent (Nickerson et al., 1985).

Comprehension itself has been seen as a critical thinking process. For instance, from a schema theory description of

reading, comprehension can be conceptualized as a critical thinking act (Anderson and Pearson, 1984; Collins et al., 1980; Norris and Phillips, 1987; Rumelhart, 1980; Aloaili, 2005d). Lewis (1991) argues that viewing reading as a critical thinking act becomes more tenable when some of the components of the reading process are accepted as automatic and necessary (automatic processes like word identification, derivation of meaning for most words, and assignment of importance), but not sufficient for constructing text understanding.

According to schema theory, the understanding and interpretation of the text are relative, which means that definitive conclusions cannot be reached. However, the readers should seek to arrive at a coherent and consistent understanding of the text being read. Lewis (1991) stated the following:

Schema theory posits that there is no absolute meaning on the page to be interpreted the same by all-that is, there is no "correct" comprehension. The goal of reading extended text is to arrive at a coherent representation of the text. This goal is achieved by readers' weighing and comparing data from their schemata, the text, and the context in which the act occurs (p. 421).

In order to enhance readers' ability to achieve and practice comprehension as a critical thinking act, researchers have shown that "the critical thinker uses his or her metacognitive knowledge and applies metacognitive strategies in a planful, purposeful way throughout the critical thinking process" (French and Rhoder, 1992, p. 191).

Gallo, 1987) uses metacognitive strategies to develop critical thinking. She suggests that improved critical thinking requires developing the processes of observation, analysis, inference, and evaluation.

Broek and Kremer (2000) made connections between inference-making and critical thinking to promote reading comprehension. They presented the idea that inferential and reasoning skills are closely related to other readers' characteristics and skills that affect text comprehension. Broek and Kremer (2000) state that:

To be successful, readers must have the inferential and reasoning skills to establish meaningful connections between information in the text and relevant background knowledge. Central to these skills is knowing what constitutes an inferential or causal/logical relation and being able to recognize or construct one when needed in order to form a coherent mental representation of the text (pp. 11–12).

Ennis (1987) classified inference as critical thinking ability which includes three somewhat overlapping and interdependent kinds of inference: deductive inference, inductive inference, and inference to value judgments. According to Albrecht (1980), deduction is referred to as "top-down thinking" because the conclusion or result is known and the search is for specific evidence that led to that particular conclusion. However, Clarke, 1990 pointed out that induction is often called "bottom-up thinking" because conclusions are drawn from specific instances, such as building on another unit the conclusion is reached

Ennis (1987) presented subskills or abilities under each of these three kinds of inference: deductive inference, inductive inference, and inference to value judgments. For example, deductive inference includes (1) class logic, (2) conditional logic, and (3) interpretations of statements. Also, inductive inference involves (1) generalizing, (2) inferring explanatory conclusions and hypotheses, and (3) giving reasonable

assumptions. Moreover, inference to value judgments requires (1) background facts, (2) considering alternatives, and (3) balancing, weighing, and deciding.

Bizar and Hyde (1989) argued that inferential thinking contains two types: drawing inferences and drawing conclusion. Regarding the first one (drawing inferences), Bizar and Hyde (1989) stated the following:

Inferential thinking involves putting together individual bits of information to derive a greater meaning than what one might expect from merely focusing on the bits themselves. When reading a passage, we infer a great deal; that is, we derive much more meaning than a literal interpretation of words" (p. 35).

Another kind of inferential thinking, drawing a conclusion, involves taking pieces of information and synthesizing them into a meaningful idea which is greater than the separate pieces (Bizar and Hyde, 1989). They concluded that drawing inferences and conclusions depend heavily on students' schemata. That is, if the student does not have the requisite knowledge or accurate schemata, he or she will not be able to build meaning from the materials being read.

6. Conclusion

The literature reveals an agreement between theorists and researchers that there is a strong relationship among reading comprehension, critical thinking, and prior knowledge. This relation is interdependent, which means that prior knowledge serves as a foundation for critical thinking and inference-making. Critical thinking and inference-making work as effective means to activate prior knowledge. Prior knowledge and thinking skills can be viewed as interdependent. Schema theory provides powerful rational and theoretical premises of building an interactive model for interpreting how reading comprehension develops by utilizing the connections between reading comprehension and critical thinking. Schema theory is considered to be one of the most effective current theories that has had a major influence in terms of changing the face of reading instruction and reading comprehension.

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