The Ethiopian Grade 9 Physics Textbooks: Do They Promote or Inhibit Students' Creative Thinking?

By

Gidissa Ejigu Delessa

A Thesis Submitted to

The Department of Applied Physics

School of Applied Natural Science

Presented in partial fulfillment of the requirement for the Degree of Master's in Physics.

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Examination Committee Approval Sheet

This is to certify that the thesis prepared by **Gidissa Ejigur:-** "**Ethiopian Grade 9 Physics Textbooks: Do They Promote or Inhibit Students' Creative Thinking?''** and submitted for partial fulfillment of the requirement for the degree of Master of Science in physics complies with the regulations of university meets the accepted standard with respect to originality and quality.

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Declaration

I hereby declare that this Master of Science thesis is my original work and has not been presented for a degree in any other university, and all sources of material used for this thesis study have been duly acknowledged.

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This Mater's of Science Thesis has been submitted for examination with my approval as thesis advisor.

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Abstract

The aim of this study was to investigate whether Ethiopian grade 9 physics textbooks promote or inhibit creative thinking of students. To realize that, the activities of the first four units in text books have been investigated through document and questionnaire analysis. In the questionnaire analysis, 10 physics teachers and 30 students from secondary school were selected for respondents using a purposely sampling technique in Mida kegn woreda. So, a qualitative and quantitative research method was used in the research. From the document analysis, it is found that out of 170 activities, 110(64.7%) were close ended questions and 60(35.3%) were open ended questions. This indicates that only 35.3% of activities were encouraging divergent thinking. When these open ended questions were identified again in to four categories of divergent thinking, more weights were given to the fluency of thought 26(15.3%) from four core components and no weight was given to novelty of thought. In addition to document analysis, the analysis of questionnaires from teachers' response shows that, in average, 72.5% of the respondents said that weight given to the four core components of divergent thinking was low. Similarly, the analysis of questionnaires from students' response indicates that, in average, 64% of the respondents said that the opportunity given to the four core components of divergent thinking was also low. Based on the result of the study, the following Conclusion could be deduced: The result obtained from document, questionnaire analysis from both teachers' and students' responses show that the activities in the textbooks that encourage divergent thinking were low. Therefore, according to the criteria (fluency, flexibility, novelty and elaboration) we used to investigate the activities in the first four units of the textbooks, the activities in the textbooks do not encourage the divergent thinking so that the Ethiopian Grade 9 physics textbooks do not promote the creative thinking of the students.

Keywords: Creative thinking; convergent thinking; divergent thinking; fluency; flexibility; novelty; elaboration

CHAPTER ONE

Introduction

There have been arguments about what creativity is but it can be said briefly that creative thinking is a kind of thinking that has original thought, seeks for new thing, suggests new solutions to old problems and provides appearance of original thoughts. It is also defined as the way of thinking that generates new approaches, original ideas and perspectives, alternative ways of understanding and comprehending concepts whereas, creativity is the potentiality to produce ideas or objects that are novel to the producer.

Creativity can be the basic foundation for economy and social progresses in every society. Because creativity has wide advantages, it has a great role in the development of one country. These advantages of creativity are social development, economic development, educational development, cultural (art) development, political development, scientific and technological development and so on. When the gap observed between the country that exercised creativity and the country no exercised creativity, there is a big difference between them in that the country that exercised creativity was developed in economy, industry, technology, etc. than the country no exercised this creativity. However, creativity exists every time even if its level is different among human being as well as among countries. Therefore, the scholars said that everyone is creativity to some degree (Erlendsson, 1999).

Creativity is essential for existence and development of both culture and industry. Were it not for creativity, there would be no technological or scientific innovations, no arts and no social revolutions (Runco 2004).

There are different kinds of creativity: Cultural (artistic) creativity involves imagination and a capacity to generate original ideas and novelty ways of interpreting the world, expressed in text, sound and image; Scientific creativity involves curiosity and a willingness to experiment and make new connections in problem solving; Economic creativity is a dynamic process leading towards innovation in technology, business practices, etc., and is closely linked to gaining competitive advantages in the economy.

Creativity is important in education, for the promotion of both the economy and industry, as well as to prepare school graduates for a rapidly changing reality (Runco 2004).Education systems throughout the world, such as in England (Yan 2005) and several East Asian countries (Cheng, 2004) have described the development of creativity as one of their main goals. Physics, for example, generates the fundamental knowledge needed for future technological advances. Physics is the gateway to careers in science, technology, engineering and medicine that are critical to the future prosperity and economic competitiveness of countries. For this purpose, it is necessary to prepare graduates for a rapidly changing world, and physics can certainly be used as a platform to train students for such a world. The development of creativity is one way of integrating them. The physics domain which is based on experiments, research, hypotheses and thinking out side of the box, can also serve as an excellent grounding for creativity development.

Creativity can be viewed from different perspectives such as the creative thinking process, the product, the creative environment and the individual. These four aspects supplement each other when used to predict a person's potentiality to create (Yan, 2005).This research work focuses on creative thinking in physics text book and to understand whether and how physics text books enable the promotion and development of creative thinking. To this end, the focus was on one aspect of creativity i.e. creative thinking process.

A. The creative thinking process

The creative process is a cognitive process leading to a creative product (Stojanova, 2010). When a person encounters a problem, he/she will produce ideas in order to deal with the problem, which will lead to more ideas, that are likely to be more original than the first ones (Runco, 2010). (Guilford, 1968) distinguished between "convergent thinking", thinking that results in the solving of a problem with one answer or with one conventional solution, and "divergent thinking", which leads to many ideas from different perspectives.

Divergent thinking reflects a flexibility of thought, which is considered to be the essence of the creative thinking process. Creative thinking includes divergent thinking which consists of four core components: fluency, flexibility, novelty and elaboration. Fluency refers to the number of ideas generated in order to get to the solution: the larger the number of the ideas, the greater the chance that one of them would be considered a good idea. Flexibility refers to the creation of different types of ideas, to the ability to change direction of thought, and examine different perspectives. Novelty refers to the creation of new and original ideas by the creator. Elaboration refers to the creation of ideas that highly detailed in order to develop a process leading to the solution, or ability to analyze the details and components of the idea as a whole (Cheng, 2010 and Stojanova, 2010). The creative thinking process has been examined in this study by focusing on the types of questions asked in the physics text books (convergent or divergent).

B. Creative thinking in physics textbooks

In order for physics textbooks to encourage creative thinking, they should contain open ended exercises and activities leading divergent thinking (Yan, 2005). Convergent thinking is characterized by closed ended exercises that are aimed at finding the best possible solution implied by the available information (Cropley, 2008). This solution can be theoretically reached by anyone with the relevant knowledge. In open activities and exercises one can diverge out in different direction and different perspectives. In these activities students have the freedom to choose the way and the tools to reach an answer.

In a study about the relationship between the degree of open endless of activities and creativity of young children, it was found that children who are exposed to a high degree of open endless in activities will show higher creative thinking abilities (Yan, 2005).

Looking two events in different ways, presenting different solutions to problems need creative thinking and critical perspective. For this reason, the Ethiopian curriculum has given place to mechanisms that support creative thinking. Creative thinking provides looking into two events from different perspectives, suggesting multi choice solutions to problems.

Being creative is a fundamental aspect of human nature and creativity is a process that can be developed and improved; everyone is creative to some degree. Therefore, this potential should be improved by giving individuals the opportunities. For this reason, activities which can give opportunities to students to improve their creativity should take place in lessons (Craft, 2007).

We investigated Ethiopian physics textbooks of grade 9. This investigation was performed by identifying the core components of divergent thinking of the open ended questions in the textbooks. This study provides new information and helps physics teachers to foster and develop the creative thinking abilities of their students.

1.1 Back ground of the study

The analyzed document was Ethiopian physics textbooks of grade 9. It was published by Federal Democratic Republic of Ethiopia, Ministry of Education (First edition 2002 E.C). It has eight units. However, we took only the first four units for investigation. As it is described above, in order for physics textbooks to encourage creative thinking of the students, they should contain open ended questions that can be characterized by; fluency, flexibility, novelty and elaboration.

Based on this idea some research papers (journals) have been written on some textbooks such as Science and Technology studying student's books, high school physics textbooks about the promotion of creative thinking of students at foreign country. However, in Ethiopia there was no such research paper has been written on this textbooks so far. So to fulfill this gap, it was necessary to conduct this document analysis of textbooks based on these instruments (criteria) to see whether they promote or inhibit creative thinking of students.

1.2 Statement of the problem

It was common practice that physics education at secondary schools promotes creative thinking. However, researches done at foreign country indicated some textbooks, such as physics textbooks, science and technology, etc. have low promotion of creative thinking of the students. This can also be reflected by lack of ability of the students to generate different ideas (imagination), to create new ideas and to generate alternative ideas (different approaches) in physics lesson. It was also true in an area where the research has been done in Mida kegn woreda at Balami secondary school. Particularly, most secondary school students have lack of creative thinking in physics education

However, even if the problem was existed, according to Ethiopian, there no research was done on these text books to identify how much they promote creative thinking of the students. It was therefore, necessary to identify whether grade 9 physics text books promote or inhibit creative thinking of the students.

1.3 The general objective of the study

The general objective of the study was to find out whether grade 9 physics text books promote or inhibit students' creative thinking.

1.4 Specific objectives of the study

The specific objectives of this study were to:

- Identify whether each activity in grade 9 physics text books promote or inhibit students' creative thinking.
- Examine what type of questions (open ended or close ended) was found in large number in grade 9 physics text books.
- Evaluate how much the activities in grade 9 physics text books encourage the four core components of divergent thinking.
- Explore whether the activities in grade 9 textbooks encourage divergent or convergent thinking.

1.5 Research Questions

The research questions were aimed to assess those activities such as worked examples, problems solving etc. in grade 9 physics text books. In doing so, questionnaires needed for study were organized.

The research questions addressed in the study were:

- What types of activities are promoting students' creative thinking?
- What types of activities are inhibiting students' creative thinking?
- What kinds of activities (open or close) are found in large number in the textbooks?
- Do the activities in the textbooks encourage divergent or convergent thinking?
- Do the activities in the textbooks contain all four core components of divergent thinking?
- Do the physics textbooks organized in such a way to promote creative thinking of the students?

1.6 Significance of the study

This study was supposed to have the following significance:

- The study helps as a source of information for curriculum developers.
- The study gives information to concerned bodies whether grade 9 physics text book promote or inhibit students' creative thinking.
- The study helps curriculum designers to develop these textbooks in such a way that they promote students' creative thinking
- The study helps other researchers as source of information,

1.7 The scope of the study

This study was conducted in Oromia region west shoa zone mida kegn woreda at Balami secondary school Balami town which is far away 236km from the capital city, Addis Abeba. In addition, two other secondary schools, Babo and kegn were selected. The study was restricted to assess the activities of the first four units of textbooks.

1.8 Limitation of the study

Some of challenges during the study was shortage of reference materials related to the study, shortage of document analysis of text book, shortage of time, shortage of access of internet (internet service) and there is no enough related researches were done so far that help to carry out the study effectively.

CHAPTER TWO

REVIEW LITERATURE

2.1 Creative thinking

It is pertinent to note that many researchers have incorrectly used the notion (concept) of ‘’creative thinking’’ interchangeably with ‘’creativity’’. Although, creative thinking and creativity are conceptually related, they are not identical. Creativity refers to the umbrella construct that includes creative thinking. Which describe the cognitive aspects of creativity (Puccio and Gonzalez 2004). According to Amabile, creativity arises through the confluence of the following three components:

Knowledge: all the related understanding an individual brings to bear on a creative effect.

Creative thinking: relates to how people approach problems and depends on personality thinking/ working style.

Motivation: motivation is generally accepted as a key to creative production and the most important motivators are intrinsic passion and interest in work itself.

One of the most important cognitive processes in creativity is divergent thinking which is also frequently used as a synonym for creative thinking. The concept of divergent thinking was first Proposed by (J.P Guilford, 1956). Divergent thinking occurs when ideas and association move in varied direction and as result new and original ideas may be found (Torranse 1976). Convergent thinking on the other hand, occurs when cognition is used to identify one correct or conventional answer (Runco2010). Guilford realizes from his research that the cognitive process of divergent thinking is unique to creative problem solving and involves the following core skills: a) fluency (the ability to generate many ideas, b) flexibility (the ability to generate different ideas, c) originality (the ability to generate original ideas and elaboration (the ability to add details to ideas.

2.1.1 Nature of creativity and innovation in the early years

The study of creativity and innovation in the early years draws on a range of influences from psychology and philosophy of childhood/child development. Spanning the nature of creativity (in particular, as opposed to innovation) and of learning or development in childhood, research psychologists, therapists, educators and careers concerned with young children all contribute with sometimes overlapping perspectives.

2.1.2. Creative processes/models of creativity and innovation

Creativity is defined with various degrees of difference by researchers, however within the discipline of psychology (where most of the recent research on creativity has been undertaken in relation to education) it is defined as "the ability to produce work that is both novel (i.e., original, unexpected) and appropriate (i.e., useful, adaptive concerning task constraints)" The notion of creativity as generating original and appropriate outcomes compresses the four P's of Person, Process, Product, Press which Rhodes originally identified, combining the production of original and valuable outcomes with the impact of these on others. Within psychology many paradigms co-exist for understanding creativity and over time there has been a transition from more linear approaches toward more integrative approaches (Lubart, 2000-2001).

2.1.3 Cognitive

The search for models that explain the mental processes and representations underpinning creative thought, the cognitive approach in psychology has investigated relationships between creativity and intelligence in which some of the recent research has suggested that creativity harnesses 'ordinary cognitive processes yielding extraordinary products' (Sternberg, 2003b). Among the first models of the creative process, (Wallas,1926) divided the creative process into four main stages (preparation, incubation, illumination and verification). The preparation phase is the gathering of internal information proper to each individual, and the external one coming from the environment. The incubation step is defined as the implementation of unconscious associations. During the illumination, the ideas appear to consciousness. The last stage of verification compares the ideas to reality and makes selections.

Similarly,(Guilford,1968), proposed a four-stage model which involved the same steps than Wallas, yet other more recent approaches, for example(Cropley,2008), have recognized the importance of communicating creative ideas successfully and so offer an extended model involving seven parts (preparation, activation, cogitation, illumination, verification, communication and validation). Cognitive approaches also include associative process, recognition that creativity involves both divergent and convergent thought. From these early models emerged recognition of certain abilities and cognitive processes involved in creativity, as, "a capacity to produce many ideas (fluency), an ability to change one's mental set (flexibility), an ability to reorganize, an ability to deal with complexity, and an ability to evaluate."

2.1.4 The shift toward understanding creativity as a social phenomenon

As well as a shift toward approaches that recognize the complexity of creativity, research over the course of the late 20th century has increasingly focused on the role of dialogue and collaboration in creativity. The field was influenced by (Gruber's 1989) work on networks of enterprise that support and enable scientific creativity inspired by his work on Darwin. It has also been given direction by the seminal research of (John-Steiner, 2000) that explored the creative work of paradigm-shifting individuals in a variety of contexts from the arts to the sciences, and revealed the extent to which artistic and scientific forms are shaped creatively through shared intellectual, emotional and passionate connection in the meaningful relationships between people. She revealed the shared struggles involved in creative generativity. Her work has been developed by many in education but particularly by (Chappell 2008)**.**

With the increasing recognition of creativity as a social phenomenon has also developed a focus on the ethics of creativity in relation to its ends. (Sternberg, 2003a) introduced the exploration of creativity and wisdom, a challenge taken up by (Claxton et al., 2008), who argue for the need to attend to the outcomes of creative effort in relation to their impact and particularly in relation to education. A focus on 'wise creativity' has been developed by (Craft, 2007) further articulated by (Craft 2011) into wise, humanizing emphasizing collaborative and communal engagement with the ethics of creativity.

2.1.5 Creativity, innovation and learning

Researchers have identified that many factors can influence the creativity of individuals (though as (Cropley, 2008), show the research area is complex and contradictory); these can be grouped into cognitive, conative, and environmental (Amabile, 1997; Lubart, 2003), (Sternberg and Lubart, 1999).

2.1.6 Cognitive factors

Factors such as intelligence and knowledge can influence creativity. Some years ago,(Guilford ,1968), noted that creativity involved certain abilities as sensitivity to problems, a capacity to produce many ideas (fluency), an ability to change (flexibility), an ability to reorganize, to deal with complexity, and an ability to evaluate. Fluency and flexibility later became a part of the Torrance tests in creative thinking.

More recently studies have explored the nature of the sub-processes involved in creativity (Lubart, 2003; Sternberg, 2010). Between these sub-processes have been identified: - problem finding, problem formulation, and problem redefinition (Mumford et al., 1996a; 1996b), the divergent thinking (the process of generating many alternative ideas), the process of forming idea combinations through random or chance-based processes, the process of reorganizing information, perception and information encoding, and using heuristics. Mumford and their colleagues examine cognitive capacities that contribute to creative problem solving.

They proposed a creative process model that organizes the sub-processes involved in categorical structures. Studies support the idea that the combination and reorganization of extant knowledge is used to generate new ideas or novel problem solutions (as it was demonstrated in the historic study of scientific revolutions) (Kuhn, 1970), but studies do not tell us how people go about combining and reorganizing existing concepts. For example, a study by (Mobley and Mumford, 1996b), provides some clues about the nature of the combination and reorganization process.

A further approach to creativity involves problem solving by analogy, which is considered as a strategy to bring together two items and to emerge a third. This may be particularly relevant in science education where it might be argued that analogy is needed to transfer thinking from one area of learning to another (Gentner, 1983).

2.1.7 Conative factors

These encompass personality, motivation and emotions. Among the personality traits important for creativity, research, especially in adults, points out perseverance, risk taking, openness to new experiences, individuality, and tolerance for ambiguity. For example, (McCrae,1987), showed that the trait 'openness' interacts with the process of divergent thinking in order to make creative production possible. Other authors show that extraversion (Wolfradt and Pretz, 2001) and psychoticism (Eysenck, 1993) are positively and strongly associated with creativity. Amble's work theorized that extrinsic motivation is insufficient for creativity (Amabile, 1998) whereas interest in the activity itself is much more likely to facilitate it.

Rewards, according to Amabile, actually have a destructive effect on creativity in general, particularly, on higher-order problem-solving. Amabile argues that the more complex the activity the more likely extrinsic motivation will block creativity, for if students perceive their learning as simply something they have to get through in order to 'win the prize', this reduces their capacity to be creative. This is particularly relevant given the wider performativity culture in which children learn across the world.(Moneta and Sui ,2001), in their exploration of the lack of creativity in the highly-extrinsically motivated education system in Hong Kong, confirm gender, school type this.

Besides certain personality traits, motivation plays an important role in creativity. Studies suggest that intrinsic motivation (i.e. curiosity, etc.) contributes positively to creativity, whereas extrinsic motivation (prizes, awards, and praise from parents or teachers) sometimes is negatively related to creativity and indeed learning generally. More recently, studies have focused on the impact of emotional states on creative performance.

However, the conclusions of these works are not consensual. The results of Isen and his colleagues (Isen, 1987) suggest that only positive emotional states, compared to neutral and negative ones, promote creative performance. While other authors have observed that the more negative emotional states encourage creativity. (Russ,1999) examined the links between creativity and emotional expressiveness in children aged 5 to 7 years old and found that the frequency of emotional themes and variety are correlated with measures of divergent thinking.

2.1.8 Environmental factors

These include the physical, social and cultural environment. In terms of the physical environment, one recent study suggests visible connection with natural environment, use of natural materials and less manufactured or composite surface materials, with use of visual detail and warm colors, seem to be important (Mitchell et al., 2002) whilst the values implied by the environment are highlighted by (Moultrie et al., 2007). Socially, the family environment may play a role in the creative process.

However the relationship with family environment is unclear. The role of schools and teachers is often emphasized in the development of creativity (Sternberg and Lubart, 1999). Creativity is increasingly understood to be a social phenomenon. Culturally there is evidence of creativity being differently interpreted in the West compared with the East being seen more as about individualism in the West and the collective in the East.

2.1.9 Creativity and innovation: distinctive concepts

In general, creativity can provide the basis for innovation; the result of creativity is innovation. Whereas, creativity is usually understood to be the construction of ideas or products which are new and potentially useful (Amabile, 1998), for example in social or monetary terms, innovation is the way in which ideas are brought to a profitable conclusion. The test of innovation therefore lies in its success in the marketplace of ideas, rather than in its novelty alone.

In a study conducted by (Kahl, da Fonseca and Witte, 2009), contemporary creativity research was investigated by conducting an analysis of 119 abstracts. The results show that the terms creativity and innovation are used interchangeably by some disciplines. According to (Cohendet and Grandadam, 2008), the creative individual is a creator or inventor, not an innovator. Innovation itself relates not only to the novelty but also to its introduction into an existing social system (Fayolle, 2004: 79) but is of course distinct from creativity in that the system of values relates to the profitable application of ideas. (Craft, 2010) has analyzed the increasing link made globally between creativity and innovation, in ‘marketing’ creativity (although she critiques this as problematic).

(Sawyer, 2006) by contrast argues that education increasingly needs to address the needs of society in which innovation is a core dimension. Drawing on studies of improvisation he suggests educators should connect to research about creativity and collaboration to develop ways of educating that attend to the role of improvisation in learning. Improvisational teams, Sawyer argues, are what are needed in the global economy and this means teaching in ways that allow students to build knowledge collectively, engage in enquiry and in productive argumentation as well as externalize their own developing knowledge. Sawyer identifies implications for lesson structure, curriculum design and teacher preparation.

2.2. Conceptualizations of creativity in curricula

Creativity in education is often framed in one of two ways (Gibson, 2005). Firstly, creativity in education can be seen through an instrumentalist perspective which sees creativity as a skill that should be developed as a route towards innovation and building a 'knowledge economy'. Creativity understood through an instrumentalist perspective is perhaps most closely informed by the cognitive, psychometric and confluence paradigms. The second way that creativity is often interpreted in education is through the notion of romantic 'self-actualization' and is tied in with a democratic ideal of creativity – that creativity is something that we are all capable of and that creativity is an important part of childhood development.

2.2.1 The challenge of orchestrating creative teaching

The challenge of orchestrating creative teaching and achieving a balance between structure and freedom in educational settings should not be underestimated. The 'disciplined improvisation' (Sawyer,2006) of creative teaching makes high demands on teachers who seek both to utilize routines in the context of wider curriculum structures/ requirements and to work flexibly in order to offer creative opportunities to build new knowledge and understanding.

Additionally, the question of the difference between creative teaching and 'good teaching' is an issue; perhaps as (Cremin et al., 2009) argue the difference is one of emphasis and intention. These researchers suggest that although good teachers recognize the importance of inventiveness, creative teachers see the development of creativity and originality as the distinguishing mark of their teaching; they are aware of, and value, the human attribute of creativity in them and seek to promote this in others.

However, the lack of recognition of creativity within policy documentation, the relentless quest for higher standards and the pressure to ensure curriculum coverage may prompt professionals to create pedagogic routines, boundaries and timetables which obscure the personal, affective and creative dimensions of teaching and learning, fostering ‘a mind-set characterized more by compliance and conformity than curiosity and creativity’ (Cremin, 2010:19). Such a mind-set may not only be adopted by teachers but also by younger learners, markedly reducing their sense of agency and possibility. Furthermore, as (Hennessy, 2003) observes some research suggests classrooms typically destroy intrinsic motivation and therefore creativity through expected evaluation, expected reward, deadlines, surveillance and competition.

Although she shows that where choice is given, intrinsic and extrinsic approaches to motivating creativity appear to have an 'additive' effect nurturing creativity even in contexts which are challenging to its development (Hennessy, 2003). Whilst the curriculum can both constrain and enable creativity, teachers can and many do exert their professional autonomy to teach creatively and teach for creativity. There is clearly scope for international research which documents more closely such pedagogic practice and fosters creativity in science and mathematics, not only in the pre-school years, but across the age phases.

2.2.2 Approaches to / conceptualizations of assessment

There are a number of different ways of approaching the conceptualization of assessment of creativity; however there appear to be three fundamental points to consider. First is what is to be assessed (i.e. is creativity seen as a process, a product, or both?); second is who should be involved in assessment (i.e. should someone outside of the creator make that judgment or does the creator have a role to play) and finally; how is creativity assessed in practice (i.e. what tools or tasks are adopted). There are two broad strands of creativity assessment, each of which has its own way of addressing the above three points. These can be characterized as psychometric approaches to assessment and componential approaches.

2.2.3 Psychometric

psychometric assessments of creativity stem from the early cognitive approaches to creativity that proposed that creativity was a general phenomenon, a 'quantity' that we each had (e.g. Guildford, 1968), and innate - with the subsequent implication that some inherently had more than others and that it could be tested using psychometric instruments. Seminal work on this was developed by (Torrance, 1976). His initial core creativity criteria of fluency, flexibility, elaboration and originality were, interestingly, adopted by the Scottish HMI Education (2006), as markers of creativity in schools. Usually assessed using standardized, criterion-referenced tests, focusing on the outcomes or products, student creativity is scored by the subject completing a series of questions, and the final product then being rated, on a scale from low to high

A psychometric approach to the assessment of creativity, then, sees creativity as generalized, object viable and measurable, adopts a focus on product rather than process, sites the locus of judgments outside of the creator, is focused on the individual's performance and embraces the use of decontextualized standardized tests enabling judgments and comparisons to be made across time and across populations but raising questions about the inherent validity despite claims made by test developers. It tends to seek to offer a summative assessment in other words summing-up performance at a point in time. By so doing it can be used to compare children over time or to compare cohorts of children; in this way a summative use of a psychometric assessment test can also, like any other summative assessment, be used to report to parents, or for accountability or monitoring. .

2.2.4 Componential assessment

With a shift in perspective in the field toward a focus on the complexity of creativity (Feldusen, 1995) in encompassing the complexity of the cognitive activity, involving interlinked processes of decision making, metacognition and critical thinking in a wider personal and social context as well as involving both the product and processes of creativity, there has also emerged a new frame for the assessment of creativity - the componential approach. This term denotes the recognition of multiple 'components' or elements, in creativity and attempts to assess creativity more holistically, and in-context, encompassing a focus on either process or product, or, more usually, both.

The work of (Amabile,1998) influential in developing the componential approach. In assessing creativity using multiple components, Amabile has developed the Consensual Assessment Technique (CAT), which involves shared expertise around criteria derived by consensus, by judges of creativity. This field of judges may include the producer – in the case of schools, the children themselves. Judges ultimately grade creative processes and products on a five-point scale from very uncreative to very creative.

Componential approaches involve the assessment of the process as well as the product. By noting the processes involved and their importance in creativity, there is an implicit corollary that these processes can be identified and, perhaps, fostered in individuals in an attempt to increase creativity. These componential approaches to assessment have important educational implications regarding the teaching of creativity in schools; and where creativity is seen to contribute to personalization, it is difficult to imagine a rationale for taking anything other than a componential approach.

Indeed in practice, the componential approach has tended to be developed in European contexts whereas North American and far Eastern contexts are more likely to use a psychometric approach, although in the North American early years classroom there remains a concern for the learner and their trajectory. The focus on componential assessment in the classroom also reflects the growing concern to capture learning for formative purposes.

A componential approach to the assessment of creativity sees creativity as contextualized, rather than general and whilst it may be evaluated it cannot be measured in quite the same way as the psychometric approach would enable. Like the psychometric approach it adopts a focus on the product but can also be used to evaluate the process. It can be adapted for use with both individuals and pairs or groups. It cites the locus of judgment with the field of judges which may include the creator/s. It highlights the vital role of context and does not seek to decontextualize the assessment; as a result it may offer insight into change over time for individuals or groups.

2.2.5 Other approaches to assessing creativity

In addition to psychometric and componential approaches, there are a number of other methods of measuring creativity. Many other assessments continue down similar psychometric routes to those outlined above and examine particular characteristics of personality supposed present in creative individuals, such as risk taking, independence, or humor or look at features of creative environments such as in the workplace and, as with the tests described above, aim to produce a creativity 'score' or 'rating'. While it is important to acknowledge the existence of these various approaches, they are less appropriate for discussion in the early year's context.

2.2.6 Nature of research approaches to creativity in early years

The field of creativity and early year's educational research is influenced by a number of key philosophical ideas. Empirical research undertaken in this field spans both positivist and interpretivist paradigms and therefore both quantitative and qualitative methodologies. Additionally, there are studies undertaken using mixed methods, particularly those interested in teachers' attitudes. Interestingly however, little research in the field of creativity in the early years appears to be undertaken in the critical paradigm, which may reflect both the age range (up to the age of eight) and perhaps also cultural beliefs around the world in relation to the education of the youngest children.

The different paradigms reflect contrasting perspectives on the underpinning ontology and epistemology ranging from a view of knowledge as 'objectively true or false' (which underpins the positivist paradigm) to a view of knowledge as 'relative to the thinker. Research undertaken in the United States and Far East tends to be undertaken more in the positivist paradigm although some very influential work has been undertaken using the interpretivist paradigm in North America. In Europe there is more of a mixed picture with interpretive research being favored by many. Educational research highlighting creativity in the early years encompasses a number of foci through which researcher's study a wide variety of aspects of children's learning and development. These might be summarized as four main themes: 'questioning', 'play', 'children's visual representations' and 'text making'.

2.2.7 Questioning

Questioning has long been associated with creativity across all age groups, both in quantitative research in the form of divergent thinking tasks and in qualitative studies. Looking at the Possibility Thinking work described, central to this is posing the question 'What if?.(Chappell, 2008) discuss their empirical work examining children's question posing and responding in the early years. It is this questioning in divergent tasks, or what they describe as 'possibility broad', they suggest, that drives Possibility Thinking and thus at the Centre of creativity. These divergent or 'possibility broad' tasks may also provide opportunities for play in the early years.

2.2.8 Multiple Dimensions of Creativity

According to (Taylor, 1988), there are more than 60 definitions of creativity, and there have been countless arguments over the accepted definition of creativity among psychologists (Amabile, 1998). Despite this lack of agreement, there are some common notions of creativity that run through the literature on creativity.

First, creativity is generally defined as the ability to produce solutions or ideas that are both novel and effective (Lubart, 2011). (Sternberg, 2010) similarly have noted that most definitions of creativity consist of three components: novelty, quality, and relevance. That is, creative solutions are novel, of high quality, and appropriate to the given task, or some variant of the task.

Second, the majority of research on creativity (e.g., confluence approaches) suggests that there are multiple variables that need to converge for creativity to manifest (Amabile, 1997). For instance, Amabile emphasized the importance of social and environmental influences on creativity. She noted that creativity is best conceptualized not as a personality trait or a general ability, but instead as a behavior resulting from particular collections of personal characteristics, cognitive abilities, and social environments.

Similarly, (Lubart, 2003) explained that the different approaches to creativity can be viewed as a continuum between "less" contextualized approaches that focus on personal characteristics, and "more" contextualized approaches that include social-cultural variables that influence individuals' creativity. (McCrae, 1987) stressed that the ability to think creatively in conjunction with an inclination to do so (i.e., disposition) leads to creative productions.

Among these factors that contribute to creativity, (Guilford, 1968) conceptualized creativity as involving four facets of divergent thinking: flexibility (the ability to produce ideas from various categories or classes), fluency (the ability to rapidly produce a large number of ideas), originality (the ability to produce ideas that are unique, novel, and uncommon), and elaboration (the ability to develop the details of an idea and carry it out). Flexibility has been recognized as an essential cognitive skill for creativity (Amabile, 1998) and is defined as the ability to generate a varied pool of ideas by switching among categories and using remote associations.

Creativity is regarded as one of the cornerstones for economic and social progress in every society. There are two possible ways to get creative people to work for an enterprise or community. The first is by attracting creative employees by good working conditions – a solution for those who can afford such an approach. For communities that are not so rich, the only solution is to foster creativity by education and by helping small and medium enterprises to create products based on creative ideas and innovations. In Slovenia, proposals for nourishing creativity and innovations emerge from the government thus forgetting that creativity does not start at University or on the first day of employment.

To increase creativity, immediate action should be taken throughout the educational system, recognizing that society needs not only creative artists but scientists, economists and engineers as well. Through the analysis of the legislation, syllabi and textbooks, it can be recognized that they do not promote or even allow creativity in science education; even more, they can be regarded as creativity killers. In such a way key documents and teaching resources are placing creative science teachers in the position of guerrillas in a battle against prevailing teaching methods influenced by high-stakes external exams or measurable outcomes. To improve science creativity, the legislation should be changed to give creativity appropriate value, and teachers must be educated to use methods that increase creativity in students, with the aim of producing open minds that will be able to work in a creative way.

In addition to fundamental language skills, creative thinking is crucial to education. Modern life is becoming increasingly complex and demanding for individuals as they go through many changes and encounter various challenges. To complicate things even further, modern societies do not only revere the informed learner, but more so the autonomous and resourceful thinker.

Enhancing creativity as a part of the critical thinking process is one of the main goals of education. It is an essential tool for problem solving and overcoming future challenges. Creativity in this context can be defined as the awareness of one's own self and surrounding conditions while engaging the imagination in order to reach a quick perspectival solution to a problematic situation (Zai-toon, 1987). Indeed, fostering creativity in the educational system creates valuable contributors to societies' future development who are responsible, well-equipped, and optimistic about encountering risks, challenges and new opportunities. This necessitates the urgency for educators to move from employing methods of rote learning towards creating a classroom atmosphere that fosters creativity.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 The research design

Qualitative and quantitative research methods were employed in this study. A purposive sampling technique was also used in process of data collection. In this way information or dates were gathered from both primary data source (teachers and students) and secondary data (document). Then the gathered data were analyzed. Finally, grade 9 physics textbooks were assessed whether they promote or inhibit students' creative thinking.

3.2 Methodology

Qualitative and quantitative research methods were employed in which a purposive sampling technique was applied. By using document investigation the activities in the textbooks were analyzed as well as in addition to this document investigation, activities were also analyzed through questionnaires in order to identify whether or how it encourage creative thinking. This was made based on the external criteria, which are four components of divergent thinking (fluency, flexibility, novelty and elaboration). In addition, the activities were examined as whether they allow more than one answer or approach. The activities were read several times to identify those questions that encourage divergent thinking, those that allow more than one answer, and those that allow new and different approaches.

3.2.1 Source and population of the study

This study was carried out in west Shoa zone at Balami secondary school Balami town. The source of data of the study includes both primary data source and secondary data source. The primary data source was the physics teachers who were selected from three secondary schools and grade 9 students from Balami secondary school. There were ten male physics teachers and thirty top three students from ten section (28 = male and 2 = female). The secondary data source was the activities of grade 9 physics textbooks (document).

The personal information of population in primary data source has been given in **table 1** below.

Table 1. Personal information of population

Personal information		Teachers	Students
Age	Below 20 years	-	30
	20-30	8	-
	31-40	1	-
	41-50	1	-
Sex	Male	10	28
	Female	-	2
Qualification	Diploma	-	-
	BSC	-	-
	BED	10	-
	MSC	-	-
Service year	Below 5years	-	-
	6-10	8	-
	11-15	-	-
	16-20	1	-
	20-25	1	-
	Above 25 years	-	-
Total		10	30

3.2.2 Sampling size and Sampling techniques

To get information from the secondary data grade 9 physics textbooks' problems, examples, activities and illustration were investigated and also to get information from primary source grade 9 physics teachers who were ten (10) in number and fifteen (30) students from grade 9 were selected by a purposive sampling techniques that has a sample size of 40.

3.2.3 Data collection instruments

The data was collected through an investigation of activities such as worked examples, calculation, problem solving, textbook activities, etc. of textbooks (document analysis) and through questionnaires (close ended questionnaires) from a purposively sampled body of grade 9 physics teachers and top three students of grade 9.

3.2.4 Questionnaires

The structured questionnaires such as close ended questionnaires were designed to get information about grade 9 physics text books towards creative thinking of the students. It is preferred in this study because it gave respondents full freedom of response. Accordingly, five (5) close ended questions were constructed for physics teachers in English language and students in mother tongue (Afan Oromo).

3.2.5 Data collection procedures

Before distributing the questionnaires a brief explanation and guidance were given for the respondents about the purpose or importance of the study and also they were advised to give a desired response confidentially. After the information or data were collected through questionnaires from the respondents, the data were organized in table form for both data collected through questionnaires and document analysis.

3.2.6 Data analysis

To collect the data, the Ethiopian grade 9 physics textbooks have been investigated. After the investigation, it was found that the workings in the textbooks included all activities in the textbooks which were needed to be studied again. There were a lot of numbers and kinds of activities in the textbooks. That's why classification of the activities was needed.

In this phase, a general investigation of the activities has been done, and then the activities were classified. The kind and number of activities have been given in Table 2. They were classified in to close ended questions and open ended questions and given in table 3.

After the classification; the activities which would not be studied (closed ended questions) were removed. The rest open ended questions were investigated again and given in table 4. Finally, these activities were classified according to their category (Flexibility, Fluency, Elaboration and Novelty) and given in table 5.

Along with this document analysis, additionally, the activities were analyzed from 10 teachers' response and 30 students' responses through questionnaires which were given in table 6 and 7 respectively.

CHAPTER FOUR

RESULT AND DISCUSSION

4.1 Document analysis

After the investigation, the activities have been classified as worked examples, calculation, problem solving, etc. This classification and the number of activities were given in **table 2.**

Table 2 The kind and number of activities in the textbooks

No	Kinds of activities	Number of activities in unit 1	Number of activities in unit 2	Number of activities in unit 3	Number of activities in unit 4	Total
1	Calculate	7	10	5	22	44
2	Categorize	-	-	1	-	1
3	Define	1	1	1	1	4
4	Describe	-	-	4	4	8
5	Discussion activities	2	1	'	-	3
6	Distinguish	1	-	-	-	1
7	Draw a graph/sketch	3	-	1	-	4
8	Drive formula	-	-	-	2	2
9	Experiment	1	-	1	-	2
10	Explain	1	2	5	4	12
11	Figure	-	6	8	-	14
12	Give example	2	-	1	-	3
13	Give example and classify	-	-	1	-	1
14	List	-	1	-	-	1
15	Observation	-	-	1	-	1
16	Problem solving	1	5	6	-	12
17	State	-	-	3	1	4

18	State and categorize	1	-	-	-	1
19	State and explain/describe	1	-	1	2	4
20	Summarize	-	-	-	1	1
21	Table	-	7	1	-	8
22	Textbook activities	4	6	3	11	24
23	Worked example	5	2	6	2	15
	Total	30	41	49	50	170

As it is seen in **table 2** above, 23 kinds and170 numbers of activities were investigated from the first four units. These activities again classified in to open ended and close ended questions in the following **table 3**.

Table 3 Number of open ended questions and close ended questions

Number	Kinds of activities	Number of activities in unit 1		Number of activities in unit 2		Number of activities in unit 3		Number of activities in unit 4		Total	
		open	close	open	close	open	close	open	close	open	close
1	Calculate	-	7	-	10	1	4	-	22	1	43
2	Categorize	-	-	-	-	-	1	-	-	-	1
3	Define	1	-	1	-	-	1	1	-	3	1
4	Describe	-	-	-	-	4	-	4	-	8	-
5	Discussion activities	1	1	1	-	-	-	-	-	2	1
6	Distinguish	1	-	-	-	-	-	-	-	1	-
7	Draw a graph/sketch	1	2	-	-	-	1	-	-	1	3
8	Drive formula	-	-	-	-	-	-	2	-	2	-
9	Experiment	-	1	-	-	-	1	-	-	-	2
10	Explain	1	-	2	-	5	-	4	-	12	-
11	Figure	-	-	5	1	1	7	-	-	6	8

12	Give example	2	-	-	-	-	1	-	-	2	1
13	Give example and classify	-	-	-	-	1	-	-	-	1	-
14	List	-	-	-	1	-	-	-	-	-	1
15	Observation	-	-	-	-	-	1	-	-	-	1
16	Problem solving	-	-	-	5	-	7	-	-	-	12
17	State	-	-	-	-	1	2	-	1	1	3
18	State and categorize	-	1	-	-	-	-	-	-	-	1
19	State and explain / describe	-	1	-	-	1	-	1	1	2	2
20	Summarize	-	-	-	-	-	-	1	-	1	-
21	Table	-	-	6	1	-	1	-	-	6	2
22	Textbook activities	1	3	5	1	1	2	2	9	9	15
23	Worked example	1	4	-	2	1	5	-	2	2	13
	Total	9	20	20	21	16	33	15	25	60	110

In **table 3** above, the activities were analyzed according to open ended and closed ended questions. First, from this analysis, out of 170 activities the numbers of close ended questions were 110(64.7%) and the numbers of open ended questions were 60 (35.3%). This indicates that the textbooks contain a large number of close ended questions that encourage convergent thinking. This result contradicts with the idea of scholars, for example (Yan, 2005) who encourage creative thinking for physics textbooks, that contain open ended exercises leading to divergent thinking.

Second, since the textbooks encourage convergent thinking, they do not let the students to; generate alternative ideas, create new ideas, analysis ideas in detail and generate large number of ideas; the larger the number of ideas, the greater the chance that one of them would be considered as good idea (Cheng, 2010). The consequence of this result causes the lack of creativity along students (society) that retards the development of economy, industry, technology, scientific innovation and etc.

This incongruence with the ideas of scholars for example, (Runco 2004) said that were it not creativity, there would be no technological or scientific innovation, no arts and no social revolution.

Therefore, it is needed to ask students open ended questions that make them looking the events from different outlooks. Activities in the textbooks should give chance to students to think, suggest different ideas, and use their creativity. For this, open ended questions should be asked mostly; where open ended questions are understood to improve creativity.

Now, the close ended questions were removed from analysis and the open ended questions were analyzed. The percentage analysis of open ended questions from total activities (170) in the first four units of textbooks was given in **table 4** below.

Table 4 the percentage analysis of open ended questions.

No	Kinds of activities	Number of activities in unit 1	Number of activities in unit 2	Number of activities in unit 3	Number of activities in unit 4	Total	Percent age
1	Calculate	-	-	1	-	1	0.59
2	Define	1	1	-	1	3	1.7
3	Describe	-	-	4	4	8	4.71
4	Discussion activities	1	1	-	-	2	1.18
5	Distinguish	1	-	-	-	1	0.59
6	Draw a graph/sketch	1	-	-	-	1	0.59
7	Drive formula	-	-	-	2	2	1.18
8	Explain	1	2	5	4	12	6.98
9	Figure	-	5	1	-	6	3.53
10	Give example	2	-	-	-	2	1.18
11	Give example and classify	-	-	1	-	1	0.59
12	State	-	-	1	-	1	0.59
13	State and explain/describe	-	-	1	1	2	1.18
14	Summarize	-	-	-	1	1	0.59
15	Table	-	6	-	-	6	3.53

16	Textbook activities	1	5	1	2	9	5.29
17	Worked example	1	-	1	-	2	1.18
	Total	9	20	16	15	60	35.3

As it is seen in **table 4** above, 60 open ended questions have been analyzed. The percentage analysis of each open ended question was done. Accordingly, explain 6.98%, textbook activity 5.29% , describe 4.71%, figure 3.53%, define 1.7%, discussion activity 1.18%, drive formula 1.18%, give example 1.18%, state and explain/describe 1.18% worked example 1.18%, calculate, distinguish, draw a graph/ sketch, give example and classify, state and summarize have the list percentage of 0.59%. From this analysis of open ended questions, as it is discussed in table 3 above, the total percentage of open ended questions coverage was 35.3% and the distribution of activities in the textbooks were not enough proportion which needs to balance and increase their quantities in order to encourage the divergent thinking.

These 60 open ended questions were selected and analyzed again according to the four core components of divergent thinking (fluency, flexibility, elaboration and novelty). The open ended questions could be marked more than one category. Findings are given in **Table 5** below**.**

Table 5.the number of fluency, flexibility, elaboration and novelty in units.

Number	Categories	Number of activities in unit 1	Number of activities in unit 2	Number of activities in unit 3	Number of activities in unit 4	Total
1	Fluency	7	6	7	6	26
2	Both Fluency and elaboration	1	7	3	3	14
3	Flexibility	-	4	6	2	12
4	Both Flexibility and Elaboration	-	-	1	-	1
5	Novelty	-	-	-	-	-
6	Elaboration	-	4	2	4	10
	Total	8	21	19	15	63

As it is seen in **table 5** above, open ended questions from 170 activities in the first four units of text books, mostly fall into the category of fluency 26(15.3%), The activity that promote both fluency and elaboration 14(8.24%), the activity that promote flexibility12(7.06%),the activity that promote both flexibility and elaboration 1(0.59%), the activity that promote elaboration10(5.88%) and novelty zero .The result obtained from this analysis indicates that the number of each category(four core component of divergent thinking) was not enough proportion as well as the total number of activities that promote the four core component of divergent thinking was insignificant which needs to balance and increase their numbers in order to encourage divergent thinking. Also the textbooks have not contained the four core components of divergent thinking that promote creative thinking of students.

However, according to (Cheng 2004, Stojanova 2010) divergent thinking consists of four core components: fluency, flexibility, novelty and elaboration. So the result disagrees with the idea of the scholars. Therefore, it needs the proportionality balance of the four core components of divergent thinking.

4.2 Analysis of items from Teachers' response: It has been given in **table 6** below

Table 6. Analysis of items from Teachers' response

5 = very high, 4 = high, 3 = moderate, 2 = low, 1 = very low

Number	Item analyzed	Response of teachers (N=10) in percent										Mean
		5		4		3		2		1		
		N	%	N	%	N	%	N	%	N	%	
1	To what extent the activities such as worked examples, review questions, textbook activities etc.in grade 9 Physics text book promote students to generate number of ideas?	-	-	1	10	-	-	9	90	-	-	2.2
2	To what extent the activities such as worked examples, review questions, text book activities etc. in grade 9 physics text book motivate students to generate different ideas?	-	-	1	10	4	40	2	20	3	30	2.3
3	To what extent the activities such as worked examples, review questions, textbook activities etc.in grade 9 Physics text book promote students to create new ideas?	-	-	-	-	1	10	3	30	6	60	1.5
4	To what extent the activities such as worked examples, review questions, textbook activities etc.in grade 9 Physics text book promote students to analyze ideas in detail?	-	-	-	-	6	60	3	30	1	10	2.5
5	When you compare the number of an open ended questions with closed ended questions in the content of text book	-	-	-	-	4	40	6	60	-	-	2.4
Average mean												2.18

A .Result and Discussion from **table 6** (percentage analysis)

From **table 6** above, first, on item No 1, 9(90%) of respondents said that low. So the result shows that the text books do not promote the students to generate large number of ideas. Therefore, the text books should be containing open ended questions that get the students to think widely to give their own response.

Second, on item No 2, 3(30%) of respondents said that very low, 2(20%) of respondents said that low, while 4 (40%) of respondents said that moderate. From this result we could conclude that 50% of the respondents said that very low/low. This indicates that the textbooks do not motivate students to generate different ideas. Thus, the textbooks must contain open ended activities that get the students to think alternatively.

Third, on item No 3, 6(60%) of respondents said that very low and 3(30%) of the respondents said that low. From this result 90% of the respondents said that very low/low.so the result shows that the textbooks do not promote students to create new ideas. Thus open ended questions should be included in the text books in order to promote the students to explore alternative and unusual solution to a problem.

Fourth, on item No 4, 6(60%) of the respondents said that moderate, 3(30%) of the respondents said that low and 1(10%) of the respondents said that very low. Since the result obtained from response was biased to moderate, the researcher could take the result as insignificant. Also the result shows that the respondents did not see deeply about the item. However, the text books should be containing open ended questions that make students to analysis ideas in detail.

Fifth, on item No 5, 4(40%) of the respondents said that moderate and 6(60%) of the respondents said that low. So the result shows that open ended questions are less than close ended questions which agree with the result of document analysis. Thus, open ended questions should be asked mostly. According to (Yan 2005) study indicates open ended activities were significantly positively related to the level of creative thinking ability of young children. Finally, the summary of results from item number 1-5 indicates that, in average, 72.5% of respondents said that low/very low which implies that the textbooks do not promote the four core components of divergent thinking.

B. Result and Discussion from **table 6** (mean value analysis)

From **table 6** above, the mean value of item number 1(2.2), 2(2.3), 4(2.5), and 5(2.4) are all fall under the category of low and item No 3(1.5) is very low. From these results the average mean value was 2.18. Since the average mean value also falls under the category of low, the opportunity of activities to promote the four core component of divergent thinking (fluency, flexibility, novelty and elaboration) is also low. According to this analysis the result is in congruence with the result obtained from document analysis. Thus, the textbooks do not encourage creative thinking of the students. This can also affect the creativity of students (society) in educational improvement, in economic development, in society development, etc. thus, creativity is important in education, for promotion of economy and industry (Runco, 2004)

4.3 Analysis of activities from students' response

Analysis of activities from students' response was given in **table 7** below.

Table7. Students' response on the item analyzed

5=very high, 4=high, 3=moderate, 2=low, 1=very low

Number	Item analyzed	Response of students(N=30) in percent										Mean
		5		4		3		2		1		
		N	%	N	%	N	%	N	%	N	%	
1	To what extent the activities such as worked examples, review questions, textbook activities etc.in grade 9 Physics text book promote students to generate large number ideas?	-	-	2	6.7	8	26.7	8	26.7	12	40	2.0
2	To what extent the activities such as worked examples, review questions, text book activities etc. in grade 9 physics text book motivate students to generate different ideas?	-	-	6	20	8	26.7	10	33.3	6	20	2.5
3	what To extent the activities such as worked examples, review questions, textbook activities etc.in grade 9 Physics text book promote students to create new ideas?	-	-	2	6.7	4	13.3	10	33.3	14	46.7	1.8
4	To what extent the activities such as worked examples, review questions, textbook activities etc.in grade 9 Physics text book promote students to analyze ideas in detail?	-	-	4	13.3	8	26.7	10	33.3	8	26.7	2.3
5	When you compare the number of an open ended questions with closed ended questions in the content of text book	-	-	2	6.7	8	26.7	8	26.7	12	40	2.0
Mean average												2.12

A Result and Discussion from **table 7**. (Percentage analysis)

From **table 7** above, First, on item No 1, 12(40%) of the respondents said that very low and 8(26.7%) of the respondents said that low. From this analysis 60% of respondents said that very low/low. This indicates the text books do not promote students to generate large number of ideas. Therefore activities that make the students to think widely open ended questions must be added to the textbooks.

Second, on item No 2, 10(33,3%) of respondents said that low. 8(26,7%) of respondents said that moderate and 6(20%) of respondents said that very low. this implies that 53.3% of the respondents said that very low/low. so, the text books do not motivate the students to generate different ideas. thus, activities should be included in the textbooks in order to motivate students to generate alternative approaches.

Third, on item No 3, 14(46,7%) of the respondents said that very low and 10(33.3) of respondents said that low. this indicates that 80% of the respondents said that very low/low. From this result, the textbooks do not initiate students to create new ideas. Thus, in order to make students to explore alternatives and unusual solutions to a problem, open ended questions should be involved in the textbooks.

Fourth, on item No 4, 10(33.3%) of the students said that low and 8(26.7%) of the respondents said that very low. From this analysis 60% of the respondents said that low/very low that indicates the text books do not initiate students to analyze ideas in detail. Thus, activities that make students to analysis ideas in detail should be involved in the textbooks.

Fifth, on item No 5, 12(40%) 0f the respondents said that very low and 8(26,7%) of the respondents said that low. From this analysis 66.7% of the respondents said that very low/low. This implies that open ended question is less than close ended question. The result obtained here agrees with the result obtained from document analysis. Therefore, more open ended questions must be added in the textbooks. Finally, the summary of results from item number 1-5 indicates that in average, 64% of respondents said that low which implies that the textbooks do not promote the four core components of divergent thinking.

B. Result and Discussion from **table 7** (mean value analysis)

From the above table, the mean value of item number 1(2,0), 2(2.5), 4(2.3), and 5(2.0) all fall under the category of low and item No 3(1.8) is very low. From these results the average mean value is 2.12. Since the average mean value also falls under the category of low, the opportunity of activities to promote the four core component of divergent thinking (fluency, flexibility, novelty and elaboration) is low. This indicates that the textbooks do not promote creative thinking of the students.

CHAPTER FIVE

CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

This study has been done to identify whether Ethiopian Grade 9 physics textbooks promote or inhibit the students' creative thinking. In this study the qualitative and quantitative research method was used. The activities in the textbooks were analyzed through document analysis. In addition to document analysis; the activities were also examined through questionnaires. In the questionnaires 10 physics teachers and 30 students on together 40 respondents that were selected by a purposely sampling technique were involved from three secondary schools in Mida kegn woreda. The obtained result through these analyses is as follows:

1. Document analysis: from this analysis, 170 activities in the first four units of the text books were studied. Out of 170, 110(64.7%) activities were close ended questions that promote convergent thinking and only 60(35.3%) of activities were open ended questions that encourage divergent thinking. These 60 open ended questions again analyzed in to four core components of divergent thinking. From four core components of divergent thinking, it is seen that more weights 26 (15.3%) were given to fluency of thought and no weight was given to novelty of thought.

2. Questionnaires analysis: It was done through percentage and mean value analysis.
A. percentage analysis; from percentage analysis of teachers' response, in average, 72.5% of the respondents said that the activities that encourage divergent thinking were low. Similarly, from students' response, in average, 64% of respondents said that the activities in the text books that encourage divergent thinking were also low.

B. Mean value analysis: from this analysis the average mean value of 2.18 obtained from teachers' response indicates that the activities in the textbooks that encourage divergent thinking were low. Similarly, the average mean value of 2.12 obtained from students' response also indicates the activities in the textbooks encourage divergent thinking were also low.

Therefore, according to the criteria (fluency, flexibility, novelty and elaboration) we used to investigate the activities in the first four units of the textbooks, the activities in the textbooks do not encourage the divergent thinking so that the Ethiopian Grade 9 physics textbooks do not promote the creative thinking of the students.

5.2 Recommendation

From the conclusion drawn above, we recommended the following:
In the case of textbooks:

- Open ended questions should be involved in the textbooks to make students to suggest alternative ideas, use their imaginations.
- Activities in the textbooks should very often give students opportunities to think creatively.
- Activities and questions in textbooks should give chance students to think differently.
- Activities in the textbooks should encourage students to analyze events from different perspectives.
- Activities in the textbooks should give chance to students to think, suggest different ideas.
- Activities in the textbooks can ask open ended questions like “what do you think about this?”, “why do you think like this?”, “what if this happened like this?, to initiate students to explore and evaluate their own answers.
- Open ended questions should be asked mostly.

For teachers:

- Teacher should give students opportunity to think creatively and should be open to their ideas. Instead of asking students to follow a fixed customary of directions in performing experiments,
- Teachers inspire students to practice their own hypotheses and develop their own experimental procedures.

For other concerned bodies (curriculum developers):

- The concerned body of a government should take creativity development as an educational goal, and dedicate the necessary resources like developing appropriate learning materials.
- Curriculum developer must focus on the textbook so that it must contain large number open ended questions. .
- Curriculum developer also focus on teaching methods, kind of questions, curriculums because as it is seen in the researches, teaching methods, kind of questions, curriculums effect creative thinking positively.

Moreover, there is a need to raise physics teachers' awareness of the importance of creative thinking in learning materials. It is advisable for physics teachers to engage in professional development courses in appropriate teaching strategies for the development of creativity, such as divergent thinking.

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Appendix A

Adama Science and Technology University

School of Applied Natural Science

Department of Physics

A questionnaire to be filled by high school grade 9 physics teachers.

Dear Respondent, the purpose of this questionnaire is to investigate the Ethiopian grade 9 physics text book whether it promote or inhibit students' creative thinking in high Schools of Mida Kegn Woreda.

The information you provide will be used only for academic purpose and your response will be kept confidential. The success of this study entirely relies on your genuine and honest responses. Therefore, be kind enough to spare your valuable time to answer all the questions. Thank you in Advance!

General Direction

1. No need of writing your name

2. Please indicate your response by putting '√' mark in the provided box.

Part I; General information

1. Name of the school _____

2. Sex: A/ Female ☐ B/ Male ☐

3. Age A/ 20-30 ☐ B/31-40 ☐ C/41-50 ☐ D) > 50 ☐

4. Qualification A/ Diploma ☐ B/BSC ☐ C/BED ☐ D/ MSC ☐

5. Year of service A/below 5 years B/6-10 ☐ C/ 11-15 ☐ D/ 16-20 ☐ 21-25 ☐

Part II

Please read each item carefully and indicate your response by marking '√' in the box against the choice as; VH=Very high, H=high, M=moderate L=low VL=very low

Number	Item analyzed	Response				
		VH	H	**M**	L	VL
1	To what extent the activities such as worked examples, review questions, text book activities etc. in grade 9 physics text book motivate students to generate different ideas?					
2	To what extent the activities such as worked examples, review questions, textbook activities etc.in grade 9 Physics text book promote students to create new ideas?					
3	To what extent the activities such as worked examples, review questions, textbook activities etc.in grade 9 Physics text book promote students to analyze ideas in detail?					
4	To what extent the activities such as worked examples, review questions, textbook activities etc.in grade 9 Physics text book promote students to create new ideas?					
5	When you compare an open ended questions with closed ended questions in the text books, it is …					

Appendix B

yuunvesiitii Saayinsii fi Teeknoloojii Adamaa

Iskuulii Appilaayidii Saayinsii Uumamaa

Dippaartimeenti Fiiziksii

Iyyaafannoon kun kan guutaamu baratoota kutaa 9 Aanaa Midaa Qanyiitin.

Kab.Barattootaa; Barbaachisummaan iyyaafannoo kanaa kitaabni barataa Fiiziksii kutaa 9 kan Itoophiyaa dandeetii kalaqa baratoota aanaa kana ni jajjabeessa immo ni laafisaa kan jedhamu xinxaluuf.

Odeefaannoon ati kennitu faayidaan isaa dhimma barnootatiif waan ta'eef offitti amanamumman barbaachiisa dha.

Milkaa'inni qorannoo kanaas deebii dhugummaa kee kennituu fi amanummaa kee irratti hundaa'a.kanaafuu, yeroo kee aarsaa gochuun deebii kee kennukeetiif baayee galatoomi.

Qajeelfama

1.Maqaa kee barreessuun barbaachisaa miti

2.Deebii kee saanduuqa kenname keessatti mallattoo '√' gochuun agarsiisi.

Kutaa I Odeeffannoo dhuunfaa

1.Maqaa Mana Barumsaa----------

2.Saala A/dhiira ☐ B/ dhalaa ☐

3.Age A/ 15-20 ☐ B/21-25 ☐

Kutaa II; erga sirriitti dubbistee booda deebii kee mallattoo '√' fayyadamuun filannoo kee guca keessatti agarsiisi.

DO=daran olaanaa O=olaanaa GG=giddu galeessa G=gadanaa DG=daran olaanaa

T/L	Yaada qaacceffame	Deebii				
		DO	O	GG	G	DG
1	Gaaffileen adda addaa kitaaba barataa Fiizilsii kutaa 9 keessaatti argaman hammam barattoonni akka yaada bal'aa maddisiisan godha.					
2	Gaaffileen adda addaa kitaaba barataa Fiizilsii kutaa 9 keessaatti argaman hammam barattoonni akka yaada haaraa burqisiisan godha.					
3	Gaaffileen adda addaa kitaaba barataa Fiizilsii kutaa 9 keessaatti argaman hammam barattoonni akka yaada adda addaa maddisiisan godha.					
4	Gaaffileen adda addaa kitaaba barataa Fiizilsii kutaa 9 keessaatti argaman hammam barattoonni akka yaada qaaccessan godha.					
5	Gaffileen banaa ta'an, gaaffilee cufaa ta'an wajjin wal bira qabaman yommuu ilaalaman…					