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## Study the Content of Science Textbooks in Middle School Course of Education Based on Jerome Bruner's Viewpoint

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### ABSTRACT

**Background:** Textbooks are one of the key elements of the education system. One of elements of textbooks is its content that should be proportionate to the title of book. **Objective:** The aim of this research is analyzing the contents of experimental science textbooks of middle school by considering the process of discovery thinking of Bruner. Considering the nature of the research, the descriptive research methodology is used for analyzing the contents of the said textbooks. The experimental sciences textbooks of middle school in school year 2009-2010 are used as statistical society, and all statistical society have been chosen as statistical sample in the form of 305 concepts. For gathering information and by considering the 18 elements extracted from the ideal of Bruner, the mentioned 305 concepts have been studied. The tool for gathering data was "Content Analysis Investigation List" by emphasize on the 18 elements of Bruner. The "Content Validity" Method is used for determining the validity of this research. Meanwhile the stability of this research is based on William Scott Method. Descriptive statistics was used for analyzing data. **Results:** The findings show that the most number of discovery thinking of Bruner is in the textbook of 1st grade and the least is in the textbook of the 3rd grade. **Conclusion:** According to this research, the level of considering of the discovery thinking are as follows:

1st grade: 8 subjects (the more), 8 subjects (medial) and 2 subjects (the least)

2nd grade: 8 subjects (the more), 7 subjects (medial) and 3 subjects (the least)

3rd grade: 5 subjects (the more), 3 subjects (medial) and 10 subjects (the least)

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## INTRODUCTION

Textbooks are one of the key elements of the education system. One of elements of textbooks is its content that should be proportionate to the title of book. Studies conducted in the field of Content of Science Textbooks in Middle School Course of Education indicate that despite numerous changes which had been applied in the content of this book, it still encounter deficiencies in conveying students to goals set (Haghighat Panah, 2006). Jerome Bruner believes that preparation of content of textbooks should be in a way that motivate students to thinking and activity. In one of his works called "discovery activities", he noted that education should make a learner as an independent thinker (Hazard, 2000 quoted from Sorensen, 2007). Jerome Bruner's Viewpoint about discovery learning is that learners learn the bests through exploration, and in fact, learners are a problem solver that with examining of hypotheses and development of generalizations are in interaction with their environment. According to Bruner, all learners have a sense of curiosity. In addition, learning is an active and social process in which students create new ideas or concepts based on current knowledge. Bruner's approach is useful and practical in which teaching and learning of structures should be the center of attention instead of domination of facts and methods which is an old problem (Bruner quoted from Goodman, 2000). Accordingly, content of textbooks should be prepared somehow that strengthen various skills in students such as conceptualization, curiosity, observation, data collection, communication, making assumptions, hypothesis test, and conclusion. In such circumstances, students will learn ways of thinking and conceptualization (Saif, 1999). Conceptualization (classification) in the learning process will help learners in memorizing, remembering and discovery. From the Bruner's Viewpoint, conceptualization that sometimes called Generic Cods or cognitive structure is achieved by discovery of learner. Cognitive structure is the main structure that learner by using it can understand similarities

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and differences and also the relationship between information. Accordingly, content of textbooks should be set in such a way that students can express their opinions freely, think about various issues and to organize their mental contents, and with this means strengthen their thinking power (Bruner, 1990). In order to achieve above objectives, several changes in the content of textbooks such as science textbooks had been conducted in various course of education by writing and editing textbooks office of the Ministry of Education in the three decades after the Revolution of Iran. Despite content changes in science textbooks, conducted studies of Fathi Vajargah (1993), Ahmadi (1989) and Haghighat Panah (2006) show that Science Education still faces shortcomings in achieving its goals. It seems that in curriculum system of the Iran the most emphasis is on transferring scientific facts and learning variety of knowledge that impose on students using mechanical and memorial methods. In addition, it appears that applied mechanisms for the dissemination of the discovery thinking in curriculum is not enough. The overall aim of this research is analyzing the contents of experimental science textbooks of middle school by considering the process of discovery thinking of Bruner.

#### *Methodology:*

In the present study, the descriptive research methodology is used for analyzing the contents of textbooks. The experimental science textbooks of middle school that was published in the year of 2009-2010 are selected as statistical population. Sample has been studied as census. It means that all the books of studied period and all pages, along with all the contents of each page including images, words, sentences and questions, are analyzed. The data collection tool is check list that have been designed based on scientific principles of Bruner's viewpoint in the field of discovery method. For creation of the list, 21 columns are designed that contains the page number, course name, course concepts and eighteen subject of Bruner's viewpoint in the field of discovery method. These eighteen subject are as follows:

1. Complexity from simple to difficult
2. Objective examples
3. Proposing contents based on prerequisites
4. Highlight key points
5. The conflict principle of concepts
6. The similarity principle of concepts
7. Query Plan
8. Being an unusual question
9. Text problem solving
10. Data collection
11. Guess
12. Use of auxiliary resources
13. Taking advantage of laboratory instruments
14. Guidance to the hypothesis
15. Guidance to the hypothesis test
16. Interaction and teamwork
17. Interpretation and evaluation
18. Summary and conclusion.

Check list of content of experimental science textbooks in terms of the discovery process was given to number of experts in this field, the field of curriculum, biology, physics, chemistry, geology and Educational Psychology, for modification and their comments. Check list was prepared in the form of main components (choices of <<->> and <<+ >>) after applying their comments. For the reliability of this study, William Scott method was used as follows:

At first, about 20% of concepts of experimental science textbooks was selected using random sampling method, and then, it was given to two individuals that are familiar with Bruner's Viewpoint and experimental science to encode according to instructions.

From the 61 analyzed concept that means 1100 analyzed unit in context, 120 subject was contrary and 980 subject was similar. Therefore, observed consistency percentage is equal to:

$$C.R = \frac{\text{consistent subject}}{\text{all subject}} \times 100 = \frac{980}{1100} = 0.89$$

Descriptive statistics (frequency, percentage) and qualitative analysis are used to analyze the data obtained from the form of content analysis.

#### *Research Objectives:*

- 1- Analysis of contents of experimental science textbooks of the 1st grade of middle school based on the process of discovery thinking of Bruner.
- 2- Analysis of contents of experimental science textbooks of the 2st grade of middle school based on the process of discovery thinking of Bruner.
- 3- Analysis of contents of experimental science textbooks of the 3st grade of middle school based on the process of discovery thinking of Bruner.

#### *Research Questions:*

1. How much the process of discovery thinking of Bruner have been considered in the content of experimental science textbooks of middle school.
  - 1.1. How much the process of discovery thinking of Bruner have been considered in the content of experimental science textbooks of 1st grade.
  - 1.2. How much the process of discovery thinking of Bruner have been considered in the content of experimental science textbooks of 2st grade.
  - 1.3. How much the process of discovery thinking of Bruner have been considered in the content of experimental science textbooks of 3st grade.

*Research Findings:***Table 1:** compliance percent rate of subjects in all science textbooks of middle school.

educational level	1st grade	2st grade	3st grade	Compliance percent rate in all science textbooks of middle school.
studied subjects				
Complexity from simple to difficult	100%	99%	99%	99.3%
Objective examples	91.7%	86.5%	88.6%	88.9%
Proposing contents based on prerequisites	100%	100%	98.1%	99.30%
Highlight key points	64.6%	77.9%	88.6%	77.4%
The conflict principle of concepts	40.6%	65.4%	60%	55.7%
The similarity principle of concepts	40.6%	65.4%	60%	55.7%
Query Plan	33.35%	29.85%	22.9%	28.5%
Being an unusual question	68.8%	50.5%	33.8%	46.9%
Text problem solving	83.3%	67.3%	61%	70.2%
Data collection	66.7%	56.7%	34.3%	52.1%
Guess	58.3%	40.4%	42.9%	46.9%
Use of auxiliary resources	61.5%	61.5%	38.1%	53.4%
Taking advantage of laboratory instruments	46.9%	47.1%	34.3%	42.6%
Guidance to the hypothesis	56.3%	40.5%	33.3%	43%
Guidance to the hypothesis test	51%	35.6%	32.4%	39.3%
Interaction and teamwork	30.3%	26.5%	22.9%	26.6%
Interpretation and evaluation	55.25%	45.2%	35.2%	49.9%
Summary and conclusion	49%	42.3%	27.6%	39.3%

As Table1 shows, lowest percentage of subjects in the experimental science textbooks of 1<sup>st</sup> grade are Query Plan and Interaction and teamwork with value of 33.35 percent and 30.3 percent, respectively. Therefore, these subjects have not being considered very well. Also, highest percent subjects are as follows:

Complexity from simple to difficult is 100 percent, Objective examples is 91.7 percent, Proposing contents based on prerequisites is 100 percent, Highlight key points 64.6 percent, being an unusual question 68.8 percent, Text problem solving is 83.3 percent, Data collection is 66.7 percent, and Use of auxiliary resources is 61.5.

Medium percent subjects are as follows:

The conflict principle of concepts is 40.6 percent, the similarity principle of concepts is 40.6 percent, guess is 58.3 percent, taking advantage of laboratory instruments is 46.9 percent, guidance to the hypothesis is 56.3 percent, guidance to the hypothesis test is 51 percent, interpretation and evaluation is 55.25 percent, and summary and conclusion is 49 percent.

Also Table1 shows, lowest percentage of subjects in the experimental science textbooks of 2<sup>st</sup> grade are Query Plan, Guidance to the hypothesis test, and Interaction and teamwork with value of 29.85 percent and 35.6 percent and 26.5 percent, respectively. Therefore, these subjects have not being considered very well. Also, highest percent subjects are as follows:

Complexity from simple to difficult is 99 percent, Objective examples is 86.5 percent, proposing contents based on prerequisites is 100 percent, Highlight key points 77.9 percent, The conflict principle of concepts is 65.4 percent, the similarity principle of concepts is 65.4 percent, Text problem solving is 67.3 percent, Use of auxiliary resources is 61.5. Therefore, these subjects have being considered very well.

Medium percent subjects are as follows:

Being an unusual question 50.5 percent, Data collection is 56.7 percent, guess is 40.4 percent, taking advantage of laboratory instruments is 47.1 percent, guidance to the hypothesis is 40.45 percent, interpretation and evaluation is 45.2 percent, and summary and conclusion is 42.3 percent.

Also Table1 shows, lowest percentage of subjects in the experimental science textbooks of 3<sup>st</sup> grade are as follows:

Query Plan is 22.9 percent, being an unusual question is 33.8 percent, Data collection is 34.3 percent, use of auxiliary resources is 38.1, taking advantage of laboratory instruments is 34.3 percent, guidance to the hypothesis is 33.3 percent, Guidance to the hypothesis test is 32.4 percent, Interaction and teamwork is 22.9 percent, interpretation and evaluation is 35.2 percent, summary and conclusion is 27.6 percent. Therefore, these subjects have not being considered very well.

Also, highest percent subjects are as follows:

Complexity from simple to difficult is 99 percent, Objective examples is 86.6 percent, proposing contents based on prerequisites is 98.1 percent, Highlight key points 88.6 percent, Text problem solving is 61 percent.

The conflict principle of concepts and the similarity principle of concepts with 60 percent and guess with 42.9 percent are medium percent subjects.

*Discussion and Conclusion:*

From analyzing the contents of experimental science textbooks of middle school, it can be concluded that in the experimental science textbooks of 1<sup>st</sup> grade, subjects of Query Plan and Interaction and teamwork have not been considered very well. Subjects of complexity from simple to difficult, objective examples, proposing contents based on prerequisites, highlight key points, being an unusual question, text problem solving, data collection, and use of auxiliary resources have been considered very well. Subjects of conflict principle of concepts, similarity principle of concepts, guess, taking advantage of laboratory instruments, guidance to the hypothesis, guidance to the hypothesis test, interpretation and evaluation, and summary and conclusion have been considered in medium level. Also, in the experimental science textbooks of 2<sup>st</sup> grade, subjects of query plan, guidance to the hypothesis test, and interaction and teamwork have not being considered very well. Subjects of complexity from simple to difficult, objective examples, proposing contents based on prerequisites, highlight key points, the conflict principle of concepts, the similarity principle of concepts, text problem solving, and use of auxiliary resources have been considered very well. Subjects of being an unusual question, data collection, guess, taking advantage of laboratory instruments, guidance to the hypothesis, interpretation and evaluation, and summary and conclusion have been considered in medium level. Also, in the experimental science textbooks of 3<sup>st</sup> grade, subjects of query plan, being an unusual question, data collection, use of auxiliary resources, taking advantage of laboratory instruments, guidance to the hypothesis, guidance to the hypothesis test, interaction and teamwork, interpretation and evaluation, summary and conclusion have not been considered very well. Subjects of complexity from simple to difficult, objective examples, proposing contents based on prerequisites, highlight key points, and text problem solving have been considered very well. Subjects of The conflict principle of concepts, similarity principle of concepts and guess have been considered in medium level. Results of this study about subjects of complexity from simple to difficult, proposing contents based on prerequisites, objective examples, highlight key points, and text problem solving in all three textbooks are consistent with findings of Doroti (2006), Sailor and Louis (2007), Hosseini Ashtije (2008), Tayebzadeh (2002), and Bardzardi (2001), and they are contradictory with researches of Soleyman pour (2003), Dadras (1999), and Pourbafrani (1996).

Doroti (2006) and Sailor and Louis (2007) noted that considering research and strengthening the research ability of student is very important in the course of experimental science. Therefore, for reaching to this purpose, different subjects such as complexity from simple to difficult, objective examples, highlight key points and text problem solving should be considered.

Hosseini Ashtije (2008) in his study found out that Content of Experimental Science Textbooks in Middle School Course of Education are designed to strengthen the morale of research in students. Also, Tayebzadeh (2002) saw the same results.

Bardzardi (2001) found that experimental science textbooks of 1<sup>st</sup> and 2<sup>st</sup> grade improve the morale of research in students by providing active content.

Results of this study about subjects that have not been considered very well in all three science textbooks such as query plan use of auxiliary resources, taking advantage of laboratory instruments, data collection, being an unusual question, guidance to the hypothesis, guidance to the hypothesis test, summary and conclusion, interpretation and evaluation are consistent with results of Soleyman pour (2003), Khalkhali (1976), Sedaghat (1996), Fardanesh and Shiran (2006), Ahmadi (1989), Arabi (1990), and Ahghar (2006), and contradictory with researches of Bardzardi (2001), Dadras (1999), Pourbafrani (1996), Tayebzadeh (2002) and Abtahi (2005).

Soleyman pour (2003) in his study found that contents of experimental science textbooks of 1<sup>st</sup> and 2<sup>st</sup> grade does not cover all required elements in the curriculum of theory of discovery.

Khalkhali (1976) in his research found that contents of experimental science textbooks of middle school of education are proposed in an inactive form.

Ahghar (2006) in his study concluded that contents of experimental science textbook of elementary school of education in 5<sup>th</sup> grade is designed in semi-active form that means lack of active involvement of students with concepts.

Sedaghat (1996) found that questions of experimental science textbook of elementary school of education in 1<sup>th</sup> and 2<sup>st</sup> grade are presented in semi-active form.

Fardanesh and Shiran (2006) concluded that most of contents of science textbook is designed to achieve the performance levels of remembering and generalization of basic concepts.

Ahmadi (1989) in his study found that from teacher's point of view, contents of experimental science textbooks are focused on transferring of scientific facts instead of improving the morale of research and discovery, and also, they are not enhance the active learning.

Arabi (1990) concluded that experimental science textbooks of middle school of education focused on memorizing formulas and experiments instead of nourishment of discipline and scientific thinking.

Bardzardi (2001) found that content, proposed activities and pictures of experimental science textbook of middle school of education in the 1<sup>th</sup> and 2<sup>st</sup> grade strengthen motivation to study and research in students by providing content in an active form.

Dadras (1999) in his study found that application of spiral learning in elementary school depends on decision making and style of teaching of teachers.

Pourbafrani (1996) concluded that comparison between contents of books in terms of active content presentation, science book of 1<sup>st</sup> grade is in the first place, and science book of 2<sup>st</sup> grade is in the second place and science book of 3<sup>st</sup> grade is in the last place.

Tayebzadeh (2001) in his study found that all required steps of research is in experimental science textbooks of middle school of education including observation, hypothesis formation, experimentation, data collection and hypothesis testing.

Abtahi (2005) concluded that content of experimental science of 4<sup>st</sup> grade is designed to improve skill of discovery and critical thinking.

#### *Suggestions:*

1. In the science book of 1<sup>st</sup> grade of middle school of education, two subjects have been applied in a poor level. These two subjects are interaction and teamwork and query plan. Therefore, the book of 1<sup>st</sup> grade should be carefully examined by experts, and poor subjects should be revised to enhance the process of discovery thinking of Bruner in the science book of 1<sup>st</sup> grade of middle school of education.

2. In the science book of 2<sup>st</sup> grade of middle school of education, three subjects have been applied in a poor level. These three subjects are interaction and teamwork, query plan and guidance to the hypothesis. Thus, the book of 2<sup>st</sup> grade should be carefully examined by experts, and poor subjects should be revised to enhance the process of discovery thinking of Bruner in the science book of 2<sup>st</sup> grade of middle school of education.

3. In the science book of 3<sup>st</sup> grade of middle school of education, ten subjects have been applied in a poor level. These ten subjects are interaction and teamwork, query plan, summary and conclusion, guidance to the hypothesis test, being an unusual question, guidance to the hypothesis, data collection, taking advantage of laboratory instruments, interpretation and evaluation and use of auxiliary resources. Thus, the book of 3<sup>st</sup> grade should be carefully examined by experts, and poor subjects should be revised to enhance the process of discovery thinking of Bruner in the science book of 3<sup>st</sup> grade of middle school of education.

This will not be achieved unless the policy makers and planners have believed in discovery thinking, and also teachers become familiar with thoughtful methods and apply them.

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