Yamaoka, T., Sumida, M., Nakayama, H., & Matsumoto, S. (2015). Comparative Study of Trends and Patterns in the questions between Lower Secondary School Science Textbooks and Ehime Prefecture’s Upper Secondary School Entrance Examinations. *Journal of Research in Science Education, 55*(4), 415-423.

訂正

におきまして、和文要約（日本語の論文題目、著者氏名、所属、要約、キーワード）が落ちておありましたので、追加訂正いたします。誌面につきましては、次頁のようになりますので、ご利用下さい。なお、J-STAGE 上の訂正記事では、該当論文の全頁の PDF をご利用頂けます。

著者ならびに関係者の皆様にお詫びを申し上げるとともに、追加訂正いたします。

日本理科教育学会「理科教育学研究」編集委員会
中学校理科教科書及び愛媛県立高校入試理科問題における
「問いかけ」に関する比較研究

山岡 武邦
隅田 学
中山 迅
松本 伸示

【要 約】

本研究では、平成17年検定済みのA社の中学校理科教科書における問いかけに見られる特徴や傾向を探ることを目的とした。分析対象とした問いかけは、508題であり、「短答式」「論述式」「選択式」といった解答形式、「科学用語」「計算」「現象説明」「理由説明」「図・グラフ」といった内容形式の観点から分析し、検討を行った。問いかけの特徴を検討した結果、次の2点が明らかとなった。（1）解答形式では「論述式」、内容形式では「理由説明」の問いかけは、第1分野と第2分野に共通して少ない傾向が見られること。（2）第1分野と第2分野における内容形式「科学用語」「現象説明」「図・グラフ」の問いかけは、よく似た傾向が見られることが明らかとなった。これらの分析結果を、愛媛県立高校入試理科問題における問いかけの特徴や傾向と比較した。愛媛県立高校入試理科問題については、山岡（2010）から、分析対象の中学校理科教科書と同じ時期の学習指導要領によるものを抽出して分析に使用した。その結果から、高校入試理科問題は、中学校理科教科書よりも問いかけの傾向に偏ったが、問いかけの内容形式では、「計算」が多く「図・グラフ」が少ない傾向があることが明らかとなった。

【キーワード】中学校理科教科書、愛媛県立高校入試理科問題、解答形式、内容形式

1 愛媛県立北宇和高等学校（兵庫教育大学大学院連合学校教育学研究科）
2 愛媛大学教育文化学部
3 宮崎大学大学院教育学研究科
4 兵庫教育大学
Comparative Study of Trends and Patterns in the questions between Lower Secondary School Science Textbooks and Ehime Prefecture’s Upper Secondary School Entrance Examinations

Takekuni YAMAOKA ¹, Manabu SUMIDA ², Hayashi NAKAYAMA ³, Shinji MATSUMOTO ⁴

1. Introduction

Even if science teachers teach lessons about the same natural phenomena, differences in their teaching methods have a strong influence on the students’ understanding. For example, teaching science using graphs produces completely different results from teaching it using calculations. It’s safe to say that the questions teachers ask their students play a very important role in determining the depth or extent of the students’ ability to think.

Bloom, Englehart, Furst, Hill, and Krathwohl (1956) were pioneers in getting teachers and students to plan objectives on all levels of the cognitive domain. The framework, which is known as taxonomy, assists teachers in planning questions that will stretch students

¹ Kitauwa Upper Secondary School, Ehime (The Joint Graduate School in Science of School Education, Hyogo University of Teacher Education)
² Faculty of Education, Ehime University
³ Graduate School of Education, University of Miyazaki
⁴ Hyogo University of Teacher Education
to respond at all levels. The questions in most science teachers’ lessons are based on the test content of their science textbooks. Hosono (1995) stated that more than half of the science teachers of the elementary and lower secondary school use a subtitle, a title of a chapter, or a passage in the science textbooks for setting the learning subject during a science class. Textbooks have a strong influence on the student’s concept formation.

Nakayama (2011) extracted 777 groups of questions from 3rd to 6th grade textbooks published by one of the authorized publishing companies. The questions were analyzed to be able to identify which focus on learning the process of problem-solving and which questions focus on the development of scientific thinking among children based on their observations and experiments. Nakayama, Salta, Mori and Watanabe (2014) (as cited by Nakayama, 2011) attempted to group the questions based on the description in five kinds of the Lower Secondary School Science Textbooks. The study aims to reveal the characteristics of science questions with the intention of improving science lessons centering on exploration activities. This is due to the performance of Japanese high school students in PISA 2006, which showed that “identifying scientific issues” was not high. Hence, in recent years, studies on the types of questions in science textbooks have become popular.

In grouping the questions, Nakayama, et al (2014) focused on the use of interrogative questions. On the other hand, Yamaoka (2010) developed a framework for science classes that focused on the differences in the level of cognitive activity. In his study, the framework of grouping was proposed as follows: “short written answer,” “long written answer,” and “multiple choice answer.” The content was classified as: “scientific terminology,” “calculations,” “explanation of natural phenomena,” “explanation of reasoning,” and “figures and graphs.” Through this study, it was possible to develop a systematic approach to identifying questions and to perform a comparative analysis of the cognitive activity level using actual questions from Lower Secondary School Science Textbooks and Ehime Prefecture’s Upper Secondary School Entrance Examinations. Further, the results of this study can be an interesting topic on the viewpoint of promoting a smooth transition from lower secondary to upper secondary schools. In fact, using the IEA/TIMSS-R Lesson Video Study done by Ogura (2001), Yamaoka, Sumida, and Ogura (2012) reported that about 60 percent of questions in 8th grade science lessons belong to the short written answer, which is said to be at the recall or memory level. By analyzing questions, teachers would be able to decrease the percentage of recall or memory level questions and increase the percentage that would trigger the students’ thinking. Walsh and Sattes (2005) stated that if the teacher always asked the questions that the students had already known, the class became monotonous, pointless, boring, and not exciting for the students. Blooser (2000) pointed out that most questions are designed to determine only whether a student does or does not know a particular item of information in most questions.

The results of TIMSS, a large scale international investigation analyzing children’s achievement, has been the subject of much discussion. Saruta (2001) reported on the detailed analysis in the solutions made by elementary and lower secondary school students in Japan and Australia. He pointed out a tendency for the amount of description required of Japanese and Australian students to increase as they go up in grade levels. Nakayama (2004) and Saruta (2006) pointed out that the Japanese lower secondary school students have a lower mean rate of correct answers for description-style problems than other countries, due to the fact that they chose to respond using the words in the problem sentence. Sumida (2005) developed an original framework for classifying description-style answers in the TIMSS. He argued that the proper use of scientific terminology was extremely important, and emphasized the importance of writing in science learning.

Sumida (2008) clarified that the appearance pattern of the interrogative sentence, as well as the contents, in elementary school science textbooks has been decreasing in all grades. For example, there are few questions asking students to describe the fundamental principle of the cause or nature of natural phenomena from interrogative sentence analysis in elementary school science textbooks. Yamaoka (2010) investigated trends and patterns within Ehime Prefecture’s Upper Secondary School Entrance Examinations over the past thirty-one years. The study extrapolated from a specific prefecture, and, based on the reliable data in terms of both quality and quantity, clarifies the grouping method of both question formats and question contents. The results of his study showed that the long written answer format and explanation of
reasoning question content appeared less frequently than other types of questions in all fields of study.

In addition, his study makes reference to the course of study and divides the time covered into three ranges; “Era I (1981–1988),” “Era II (1993–1997),” and “Era III (2002–2007).” It became clear that trends in the method of questioning for science questions from Ehime Prefecture’s Upper Secondary School Entrance Examinations dramatically changed, especially between Era I and Era II. Yamaoka (2010) extrapolated from a specific prefecture, “Ehime Prefecture”, to make his diachronic analysis of questions reliable in a quantitative manner.

This study was to analyze questions in Lower Secondary School Science Textbooks with reference to the study of Yamaoka (2010). This study also compared trends and patterns in the questions between Lower Secondary School Science Textbooks and Ehime Prefecture’s Upper Secondary School Entrance Examinations. For comparison, the Lower Secondary School Science Textbooks and Ehime Prefecture’s Upper Secondary School Entrance Examinations were synchronized based on the Japanese course of study. The questions of Ehime Prefecture’s Upper Secondary School Entrance Examinations were extracted for this analysis from Yamaoka’s study (2010) to compare their question formats and contents with those in Lower Secondary School Science Textbooks. The Lower Secondary School Science Textbooks analyzed in this study have been used in a large share of Ehime Prefecture schools, and more than 90 percent of the lower secondary school students in Ehime Prefecture take the upper secondary school entrance examinations. Therefore, the design of this analysis could fit the purpose of this study satisfactorily.

In reality, the questions in the entrance examinations impose various restrictions on science classes. It provided concrete evidence that efforts to measure the characteristics of science questions can quantitatively improve teachers’ classes, thereby leading to the promotion of students’ critical thinking and sound judgment.

2. Method of Study

2.1. Subject of Analysis

Our subjects of analysis were Japanese Lower Secondary School Science Textbooks published by Company A that were approved by the Ministry of Education in 2005. There were also other Japanese Lower Secondary School Science Textbooks being published by some publishing companies aside from Company A. However, all textbooks are required to follow the Japanese course of study and should acquire the textbook authorization system in Japan. This is to ensure the qualitative level of the Lower Secondary School Science Textbooks. In Japan, textbooks are used by students attending compulsory education free of charge. Valverde, et al. (2002) reported that Japanese textbooks have a small number of pages and the contents are selective, as is widely known.

Furthermore, the Japan Federation of Publishing Workers’ Unions (2010) states that the Lower Secondary School Science Textbooks of Company A occupied the highest rank in the nationwide share. This study focused on the Lower Secondary School Science Textbooks of Company A.

Hereafter, these will be referred to simply as “science textbooks.” There are four such textbooks, called Field 1- First Volume, Field 1- Second Volume, Field 2- First Volume, and Field 2- Second Volume. For the most part, Field 1 includes content relating to physics and chemistry, while Field 2 includes content relating to biology and earth science. Additionally, the four science textbooks have encompassing contents that integrate the subject contents together. In this study, these will be referred to as general science. It has been mentioned in few pages of science textbooks since the students need to study it in the last summary when they reach the 9th grade. The particular characteristics of the science textbooks are shown in Table 1. The circle in the list shows which content each field subject corresponds to.

2.2. Process of Analysis

In this study, the grouping method developed by Yamaoka (2010) was employed. Lower Secondary School Science Textbooks include texts, photographs, figures, and tables. Within the text, there are pictures of students, characters, and dialogue boxes for scientific words spoken by said characters. The complete text of science textbooks was extracted as primary text data. Then, the 532 questions within them were further extracted as secondary data. Included in this study are test contents of the science textbooks followed by comprehension questions and the final exercise of each chapter, section, and so on. The question data were divided into sections corresponding to the four textbook volumes, and organized into a text database to analyze their format and content. In total, there were 155 questions
3. Trends and Patterns in the Questions of Science Textbooks

3.1. Grouping of Questions by Format

All 508 questions were sorted into the following formats: “short written answer,” “long written answer,” and “multiple choice answer.”

Here, “short written answer” refers to questions that can be answered with a single phrase, calculation, or so forth. “Long written answer” refers to questions that require descriptions of one or more sentences.

“Multiple choice answer” includes questions that allow students to choose their answer from among a number of choices.

The science textbooks’ questions were divided into these three groups. The results are shown in Table 2. Based on the results of chi square calculations, Table 2 rejects the null hypothesis and accepts an alternative hypothesis ($\chi^2 = 2.508, df=2, ns$). The results show that all question formats in both Field 1 and Field 2 had similar trends and patterns.

3.2. Grouping of Questions by Content

Even questions of the same format contained a good deal of variety in their content. For example, compare these two questions:

Question A: “What gas is generated from the reaction of lime water and hydrochloric acid?”

Question B: “You see a bolt of lightning, then hear the thunderclap six seconds later. How far away could the lightning strike?”

Table 1. The Particular Characteristics of Science Textbooks

| Science textbooks | Contents                        | Physics | Chemistry | Biology | Earth science | Generalscience |
|--------------------|---------------------------------|---------|-----------|---------|---------------|----------------|
| Field 1 — First Volume | Phenomena in our daily lives |         |           |         |               |                |
|                     | Materials in our daily lives    |         |           |         |               |                |
|                     | Electric current                |         |           |         |               |                |
| Field 1 — Second Volume | Chemical change and atoms/molecules |         |           |         |               |                |
|                     | Motion and force                |         |           |         |               |                |
|                     | Energy                          |         |           |         |               |                |
|                     | Technology and human beings     |         |           |         |               |                |
| Field 2 — First Volume | The world of the plant          |         |           |         |               |                |
|                     | Changes in the Earth            |         |           |         |               |                |
|                     | The world of the animal         |         |           |         |               |                |
| Field 2 — Second Volume | Weather and its Change          |         |           |         |               |                |
|                     | Cells and growth of organisms   |         |           |         |               |                |
|                     | The Earth and Space             |         |           |         |               |                |
|                     | Nature and human beings         |         |           |         |               |                |

in Field 1- First Volume, 116 in Field 1- Second Volume, 122 in Field 2- First Volume, and 139 in Field 2- Second Volume, for a total of 532. Because of having reclassified these into fields such as Physics, Chemistry, Biology, Earth Science, and General Science, there were 121 questions in Physics, 137 in Chemistry, 111 in Biology, 139 in Earth Science, and 24 in General science. Since there were fewer questions in General Science than in other fields, they were not counted in the following analyses. Finally, the list was trimmed down to 508.

In total, there were 258 questions in Field 1, both in Field 1—First Volume and Field 1—Second Volume, except for General Science, and 250 in Field 2, both in Field 2—First Volume and Field 2—Second Volume, except for General Science, for a total of 508. In this study, the 508 questions within the test content of science textbooks were used to investigate trends and patterns.

This study investigated the characteristics of questions with a total of 532 in Japanese Lower Secondary School Science Textbooks using the grouping method developed by Yamaoka (2010). Furthermore, the trends and patterns within those textbooks with the test content of Ehime Prefecture’s Upper Secondary School Entrance Examinations were compared. Also, the problems were identified from the point of view of the similarities and differences in the question formats and contents between Lower Secondary School Science Textbooks and Ehime Prefecture’s Upper Secondary School Entrance Examinations.
On the other hand, “Calculations” and “Explanation of reasoning” accounted for the lowest number, about 15.6 percent. The results of chi square calculations, as shown in Table 4 accepts the null hypothesis as true ($\chi^2=12.88$, $df=4$, $p<.05$). The results of residual error analysis revealed that in Field 1, there were many “Calculations” questions, while in Field 2, there were few “Calculations” questions. Thus, it is clear that the questions in “Calculations” contents follow dissimilar trends and patterns.

Figure 1 shows the frequency of the question content categories in each science textbooks, using percentages.

In every content, there was a high proportion of “Scientific terminology,” “Explanation of natural phenomena” and “Figures and graphs” questions. Both Field 1 and Field 2 contained more than 27.9 percent “Scientific terminology” questions, and showed similar proportions of the “Explanation of natural phenomena,” “Explanation of reasoning,” and “Figures and graphs” question content categories as well.

Both Questions A and B can be grouped under the same format, “Short written answer.” However, Question A was about “Scientific terminology,” whereas Question B was on “Calculations.” The contents of the 508 questions were divided into the following groups: “Scientific terminology,” questions asking students for a certain phrase or term; “Calculations,” questions asking students to perform a mathematical calculation; “Explanation of natural phenomena,” questions asking students to describe the cause or nature of natural phenomena; “Explanation of reasoning,” questions asking students to describe the fundamental principle of the cause or nature of natural phenomena; and “Figures and graphs,” questions that ask students to create graphs or other models.

Table 3 shows these categories, and provides an actual example for each from the science textbooks. The questions in the science textbooks are sorted into these five groups. The results are shown in Table 4.

Table 4 shows that together, the “Scientific terminology,” “Explanation of natural phenomena,” and “Figures and graphs” categories accounted for 84.4 percent of all questions.

| Contents | Scientific terminology | Calculations | Explanation of natural phenomena | Explanation of reasoning | Figures and graphs | Total |
|----------|------------------------|--------------|----------------------------------|-------------------------|-------------------|-------|
| Field 1  | 72                     | 33           | 74                               | 16                      | 63                | 258   |
| Field 2  | 84                     | 11           | 66                               | 19                      | 70                | 250   |

※ The numbers in the table refer to the frequency of questions.
3.3. Comparative Study of Trends and Patterns in the questions between Science Textbooks and Ehime Prefecture’s Upper Secondary School Entrance Examinations

The results of the analysis of science textbooks’ question formats and contents were compared with those of Ehime Prefecture’s Upper Secondary School Entrance Examinations. Ehime Prefecture’s Upper Secondary School Entrance Examinations consist of 5 subjects: English, Japanese, math, social studies and science.

Subsequently, “Science Textbooks” will be referred to simply as “ST,” while “Ehime Prefecture’s Upper Secondary School Entrance Examinations” will be referred to simply as “EE.”

Yamaoka (2010) investigated the trends and patterns within the test content of EE over the past 31 years. 1,331 questions were extracted and organized into a text database in order to facilitate the analysis of their format and content.

They were sorted into the format and content categories used in the analysis of ST, then divided into two groups, corresponding to the content of Field 1 and Field 2. For an accurate comparison, synchronization was performed between ST and EE based on the course of study.

Finally, a total of 212 questions over the past six years from 2002 to 2007 were extracted. There were 105 questions in Field 1 and 107 questions in Field 2. 1) EE was performed to determine the answer to a 50-point scale for 50 minutes. The scores of EE from 2002 to 2007 were: 33.1 points, 29.1 points, 28.0 points, 33.4 points, and 31.7 points. The average score over the six years was 31.5 points.

Table 5 shows the frequency of the question formats between ST and EE. Figures 2 and 3 show the frequency of both the question formats and contents between ST and EE, using percentages.

From the results of the chi square calculations, the part of Field 1 in Table 5 accepts the null hypothesis as true ($\chi^2=12.19, df=2, p<.01$). The results of residual error analysis revealed that in EE (Field 1), there are few “Long written answer” questions, while in ST (Field 1), there are many “Long written answer” questions. Thus, it’s clear that the questions in “Long written answer” contents follow dissimilar trends and patterns.

Based on the results of chi square calculations, the part of Field 2 in Table 5 accepts the null hypothesis as true ($\chi^2=7.85, df=2, p<.05$). The results of residual error analysis revealed that in EE (Field 2), there were many “Multiple choice answer” questions.

Table 6 shows the frequency of the question contents between ST and EE. Figures 4 and 5 show the frequency of both the question formats and contents between ST and EE, using percentages.
Conclusion

The purpose of the study is to investigate the characteristics of questions in Lower Secondary School Science Textbooks used in Japan. It is clear that all question formats in both Field 1 and Field 2 had similar trends and patterns. The results show that there are many “Calculations” questions in Field 1, while there are few “Calculations” questions in Field 2. Furthermore, the study compares the trends and patterns of questions in the textbooks with the test content of Ehime Prefecture’s Upper Secondary School Entrance Examinations. The study finds that questions in Science Textbooks...
and Entrance Examinations have interesting dissimilar trends and patterns. Specifically, in Field 1, ST has more “Long written answer” questions than in EE. In Field 2, ST has less “Multiple choice answer” questions than in EE. The results show that EE has more closed questions, like “Multiple choice answer”, than in ST.

On the other hand, the results show that in Field 1, EE has more “Calculations” questions than in ST. In Field 2, EE has more “Calculations” and fewer “Figures and graphs” questions than in ST. Based on the results, the proportion of the “Calculations” in EE is higher, while “Figures and graphs” is lower than in ST.

5. Suggestions for Science Lessons

Both closed and open questions are well known as the most basic grouping. In general, closed questions have single correct answers, for example, Yes/No, a name and a date, et cetera. Open questions have no single correct answer, as there are many possibilities.

In this study, closed questions often used both “Short written answer” and “Multiple choice answer” formats. In particular, it is clear that EE has more “Multiple choice answer” question formats than in ST. “Long written answer” also used open questions format. Closed questions are characterized such that the control of the conversation stays with the questioner. More than 90 percent of the students in the lower secondary school took the EE. In the exam, there were few “Long written answer” questions in EE (Field 1). On the contrary, there were many “Multiple choice answer” questions in EE (Field 2). These trends in the EE questions will have an effect on the use of science textbooks. If the designs of science lessons encourage the use of problem-solving, decision making, et cetera, a mixture of closed and open questions should be used. At the same time, it is necessary to be careful not to come up with too many specific question formats, in the specific field.

This study classified the questions in the Lower Secondary School Science Textbook. Analyzing those textbooks will help us understand the classes better. It would be good to make more effective use of a mixture of variety question formats in the classes. In this regard, the analysis of textbooks seems productive. The use of a variety of questions and question types in science
lessons provide a needed respite from the normal school routine, and, importantly, it also motivates students to think critically.

Note
1) The data of Ehime Prefecture’s Upper Secondary School Entrance Examinations over six years from 2002 to 2007 was extracted for this analysis from the study of Yamaoka (2010).

Acknowledgment
This work was supported by JSPS KAKENHI Grant Number 20300260.

Supplementary Note
Some parts of this paper were presented at the International Conference of East-Asian Association for Science Education, Korea in 2011.

Yamaoka, T., & Sumida, M., & Nakayama, H. (2011). Comparative Study of Trends and Patterns Within the Test Content between Junior High School Science Textbooks and Ehime Prefecture’s Upper Secondary School Entrance Examination: International Conference of East-Asian Association for Science Education, EASE 2011 Conference Proceedings, 93.

References
Bloom, B., Englehart, M., Furst, E., Hill, W., & Krathwohl, D. (1956). Taxonomy of Educational Objectives, The Classification of Educational Goals Handbook 1. New York: David McKay, 62–77.
Blosser, P. (2000). How to Ask the Right Questions. National Science Teachers Association, 1–15.
Hosono, J. (1995). Research Report of The Basic Research on the Function of Textbooks as ‘Learning Materials’. Grant-in Aid for Scientific Research, “Grant Number: 04306007.”

Japan Federation of Publishing Workers’ Unions. (2010). The textbooks report No.53. Japan Federation of Publishing Workers’ Unions, 70–72.
Nakayama, H. (2004). Research Report of Investigation of Students’ Academic Abilities in Essay Type Test for Science. Grant-in Aid for Scientific Research, “Grant Number: 13480037.”
Nakayama, H. (2011). Setting of Questions in Science Learning. Saruta, Y. & Nakayama, H. (Eds.). School Science Lessons Which Unite Thinking and Representing. Toyokan Publishing, 16–28.
Nakayama, H., Saruta, Y., Mori, T., & Watanabe, T. (2014). What is the Ideal Questioning in the Education of Scientific Inquiry?: Differences in Types of Questioning Terms by Inquiry Stage in the Science Textbooks of Lower Secondary School in Japan. Journal of Research in Science Education, 55(1), 47–57.
Ogura, Y. (2001). Lesson Study: Science Lessons’ Record from I to IV. Research Report of Study on Science Lessons through Lesson Videos and the Effective of Application to Teacher Education: Collaboration with the IEA/TMSS-R Lesson Video Study. Grant-in Aid for Scientific Research, “Grant Number: 12308007.”
Saruta, Y. (2001). Research Report of Analysis on Ability of Explaining Natural Phenomena Using Sentences and Figures. Grant-in Aid for Scientific Research, “Grant Number: 10480030.”
Saruta, Y. (2006). Research Report of A Study on the Trend in Logical Expression at School Science. Grant-in Aid for Scientific Research, “Grant Number: 15300265.”
Sumida, M. (2005). Characteristics of the Answers of Primary and Secondary Students for the Issue of TIMSS Description Form. An Annual Report of the Japan Society for Science Education, 19(6), 60–70.
Sumida, M. (2008). Characteristics of an Interrogative Sentence in Elementary School Science Textbooks. Educational Forum, 6, 2–11.
Valverde, G., Bianchi, L., Schmidt, W., McKnight, C., & Wolfe, R. (Eds.). (2002). According to the Book: Using TIMSS to Investigate the Translation of Policy Into Practice in the World of Textbooks. Dordrecht, The Netherlands: Kluwer.
Walsh, J.A., & Sattes, B.D. (2005). Quality Questioning: Research-Based Practice to Engage Every Learner. Corwin Press, 53–54.
Yamaoka, T. (2010). Trends and Patterns Within the Test Content of Ehime Prefecture’s Upper Secondary School Entrance Examinations. Journal of Research in Science Education, 50(3), 145–154.
Yamaoka, T., Sumida, M., & Ogura, Y. (2012). Study on “Questioning” of the Teacher in Lower Secondary School Science Class. Proceedings of the 62nd Conference of the Society of Japan Science Teaching, 257.

(2014年5月31日受付、2014年12月19日受理)
中学校理科教科書及び愛媛県立高校入試理科問題における「問いかけ」に関する比較研究

山岡 武邦
隅田 学
中山 迅
松本 伸示

【要約】

本研究では、平成17年検定済みのA社の中学校理科教科書における問いかけに見られる特徴や傾向を探ることを目的とした。分析対象とした問いかけは、508題であり、「短答式」「論述式」「選択式」といった解答形式、「科学用語」「計算」「現象説明」「理由説明」「図・グラフ」といった内容形式の観点から分類し、検討を行った。問いかけの特徴を検討した結果、次の2点が明らかとなった。

(1) 解答形式では「論述式」、内容形式では「理由説明」の問いかけは、第1分野と第2分野に共通して少ない傾向が見られること。
(2) 第1分野と第2分野における内容形式「科学用語」「現象説明」「図・グラフ」の問いかけは、よく似た傾向が見られることが明らかとなった。これらの分析結果を、愛媛県立高校入試理科問題における問いかけの特徴や傾向と比較した。愛媛県立高校入試理科問題については、山岡（2010）から、分析対象の中学校理科教科書と同じ時期の学習指導要領によるものを抽出して分析に使用した。その結果から、高校入試理科問題は、中学校理科教科書よりも閉じた問いかけが多いため、そして、内容形式では、「計算」が多く「図・グラフ」が少ない傾向があることが明らかとなった。

【キーワード】中学校理科教科書、愛媛県立高校入試理科問題、解答形式、内容形式

1 愛媛県立北宇和高等学校（兵庫教育大学大学院連合学校教育学研究科）
2 愛媛教育文化大学
3 宮崎大学大学院教育学研究科
4 兵庫教育大学