Survey and Statistical Analysis on the Present Situation of Science Illustration Teaching in Junior Middle School

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Abstract

China's junior middle school "Science" textbook of Zhejiang Education edition has a great feature: many illustrations are carefully selected, and the pictures and texts are truly combined. Illustrations can clearly express rich scientific knowledge through intuitive images. If illustrations can be effectively used in the teaching process, interspersing them in the teaching will be conducive to stimulating students' interests and broadening their horizons. This paper is based on the textbook of "Science" of Zhejiang Education edition, and mainly investigates the application of illustrations in junior middle school science teaching by conducting a questionnaire survey on students. Through the survey statistics, we understand the present situation of illustration teaching: students pay more attention to the illustrations, but they do not use and master the illustrations enough. In response to this problem, we propose three strategies for teaching illustrations: materializing abstract illustrations, simplifying complex illustrations, and using experimental illustrations to develop students' observation ability.

Keywords: *illustration; survey and analysis; junior middle school science; classroom teaching*

1. Introduction

Textbooks are the main basis for teachers to carry out the teaching process, and its changes will affect teachers' methods and emphasis on knowledge imparting.

The junior middle school "Science" textbook of Zhejiang Education edition has made a great breakthrough based on the concept and requirements of the new curriculum standard [1, 2]. One of the most notable features is the streamlining of textual descriptions and an increase in the number of illustrations. In a set of six books, there are more than 1400 illustrations, with an average of 1-2 illustrations per page. In terms of size, some of the larger illustrations take up at least half a page. These illustrations are interwoven, vivid, and show the beauty of science in an intuitive and comprehensive way, containing a strong humanistic, artistic, interesting, and scientific nature [3]. The way of imparting scientific knowledge is no longer limited to textual expression, but can also display the most real experimental and natural phenomena through vivid pictures [4, 5]. How to effectively play the role of illustrations in textbooks and teach students the corresponding ability to read pictures has also become part of the teaching objectives.

Illustrations in textbooks can be broadly classified into real photos, models, cartoons, and diagrams. The functions of these illustrations are mostly based on explanation and expansion, and not many of them have decoration as their main function [6]. Through the use of these illustrations, it is convenient for students to understand the knowledge of textbooks, exercise their ability to read pictures, and stimulate their interest in learning [7, 8].

In this paper, a sample of students in a junior middle school in Hangzhou, Zhejiang Province, were surveyed through a questionnaire about the development of the functions of illustrations in science textbooks and the level of students' mastery, to understand how illustrations are used in the classroom today. By investigating how well these illustrations fit in with the content of the textbook, and whether they help students to gain a comprehensive and complete understanding of science, we analysed and summarized the impact of illustrations in scientific textbooks on students' learning, hoping that students will be able to dig deeper into the content contained in illustrations in the learning process.

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2. Survey description

In response to the content of the survey in this paper, we have compiled a corresponding questionnaire. The questionnaire was mainly multiple-choice questions, with a time limit of 10-15 minutes, and the answer is anonymous.

The survey respondents took students from a junior middle school in Hangzhou, Zhejiang Province as the target group, and a total of 160 questionnaires were returned. Among them, there were 157 valid questionnaires, and the effective rate of the returned questionnaires was 98.125%.

Since the school is a large-scale school in the district, the students come from all over the country and a small number of students from as far as the northeast. This shows that the composition of the students is representative, and thus the results obtained are more scientific.

3. Survey results and analysis

3.1. Students' views on illustrations in textbooks

The first question in the questionnaire was "Have you ever paid attention to the illustrations in science textbooks?". The statistics on whether students pay attention to the illustrations and how often they pay attention to the illustrations are shown in Figure 1.

As can be seen from Figure 1, 73.89% of the students chose A, indicating that they would pay attention to the illustrations in the textbook, while the rest of the students did not pay enough attention to the illustrations, and even a small number (1.91%) of the students did not pay attention to the illustrations in the textbook. The above shows that the illustrations in the textbook are still widely concerned by students, but the difference in the degree of concern is still large. Whether or not to pay attention to illustrations is a qualitative difference.

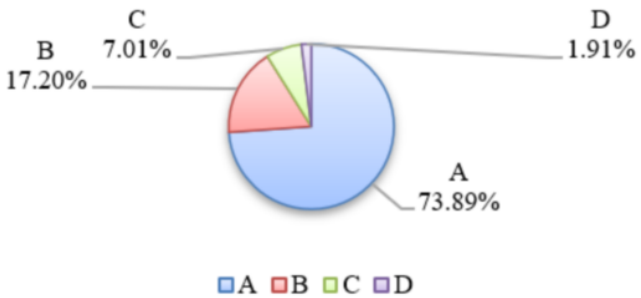

Figure 1. Statistics on the proportion of students with various degrees of attention to textbook illustrations

*A: Always yes; B: Sometimes; C: Not too much; D: Never

The second question was "What type of illustrations in textbooks do you like? (Multiple choices)", and the students' preference for the types of illustrations is shown in Figure 2.

Figure 2 shows the preference of students for the types of illustrations in the textbook. More than 65% of the students chose the illustrations of real photos and cartoons, followed by about 45% of the students who chose the illustrations of models, while the percentage of students who chose the illustrations of diagrams (24.84%) was obviously lower than the first three. This shows that although students will have concerns about the illustrations in textbooks, they pay more attention to the first three types of illustrations because they are still junior middle school students and the psychological developmental characteristics will make them interested in images, concrete and vivid things. But it is precisely for these reasons that they stay more on superficial sensory interests, and mostly focus on "appreciation" rather than exploration.

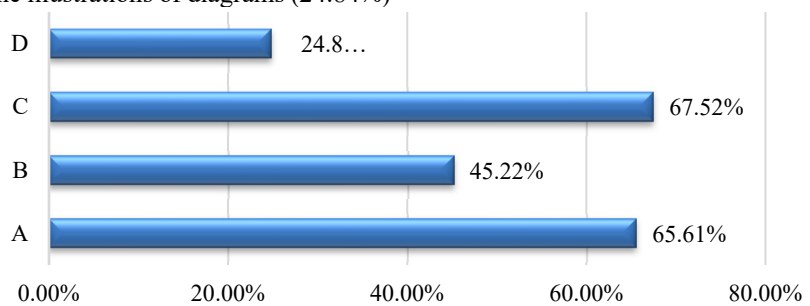

Figure 2. Statistics on the proportion of students with different preferences for illustration types

*A: Real photo type; B: Model type; C: Cartoon type; D: Diagram type

The third question was "What do you think are the advantages of studying illustrations in textbooks? (Multiple choice)", and the proportion of students in each category regarding their opinion of the advantages of illustrations in textbooks is shown in Figure 3.

From Figure 3, we can clearly recognize the students' views on the advantages of illustrations. Almost 90% of the students believed that the pictures were more intuitive and easier to understand than the textual description, which can help them understand and memorize scientific knowledge; over 75% of the students believed that the inclusion of illustrations was conducive to the integration and organization of knowledge in the textbook, which can better demonstrate the connotation and external expansion of knowledge, and help students have a more objective and comprehensive understanding of scientific knowledge; more than half of the students believed that illustrations in the textbooks could help liven up the atmosphere of the classroom, stimulate their interest in learning and activate their own thinking to broaden their imagination of things. It can be seen that the illustrations in the textbooks play a key role in the students' learning process.

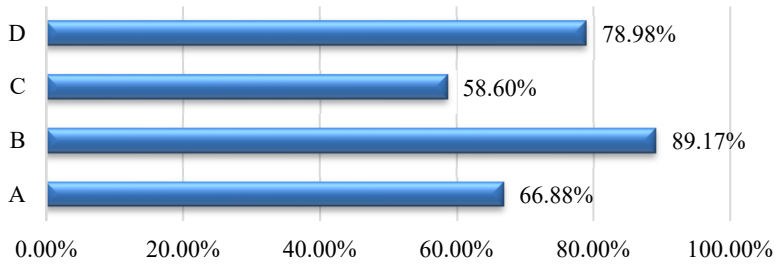

Figure 3. Statistics on the proportion of students with different views on the advantages of the illustrations

*A: It can liven up the classroom atmosphere and stimulate students' interest in learning science; B: Pictures are more intuitive and popular than textual representations, which can strengthen the memorization of scientific knowledge; C: It can enrich our imagination of things and activate our thinking; D: It is conducive to the integration and organization of knowledge, and at the same time, it can better highlight the connotation and extension of knowledge, making our understanding of scientific knowledge more objective and comprehensive

Question 4 was "What factors will influence your attention to the illustrations? (Multiple choice)". The percentages of students who believe that different factors influence their attention to illustrations are shown in Figure 4.

Figure 4 shows the factors that students think affect their attention to the illustrations, and this question is to ask students from the opposite side which situation will reduce their attention to illustrations. It can be seen from the data that there was little difference in the influence of teacher guidance, difficulty of the illustrations and their own interest, but the most influential one was that the illustrations are too difficult, which leads to the fact that students have the will to understand the illustrations but their own ability is not enough. At this point, teachers need to have enough help and guidance to break through the objective difficulties to reduce the difficulty of students' understanding of illustrations, and then teach students appropriate illustration skills in this process to improve their own reading ability.

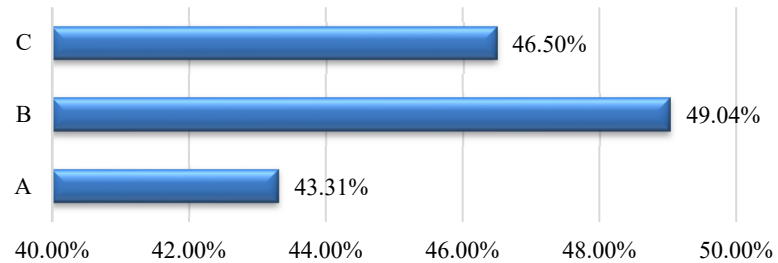

Figure 4. Statistics on the proportion of students who believe that different factors influence their attention to illustrations

*A: I am not interested in the illustrations; B: The illustrations are too difficult to understand; C: The teacher does not provide enough guidance

3.2. Students' views on teachers' illustration teaching

Question 5 was "In your regular teaching, in which way would you like your teacher to present illustrations?". The statistics of the number of students' preference for which kind of illustration presentation in class are shown in Figure 5.

From Figure 5, we can know the students' views about teachers' use of illustration-based teaching aids. Total of more than 90% of the students hoped that the illustrations were presented as a specific thing, such as a physical projection, a courseware, a wall chart, or a textbook, which could be seen and not just a verbal description, they were willing to believe that seeing is believing. Due to the continuous updating of teaching methods nowadays, students hoped that they can see the physical objects as much as possible. In the case that the physical objects are difficult to obtain, they also hoped that teachers could add corresponding illustrations by adjusting the courseware, rather than being limited to the type of textbooks, so that the students were able to see a wide variety of illustration presentation types.

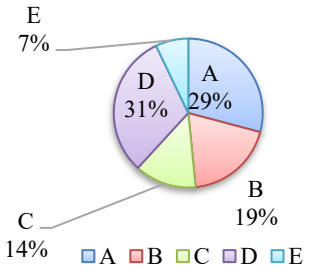

Figure 5. Statistics on the proportion of students who want the illustrations to be presented in which way

*A: Courseware; B: Wall chart; C: Textbook; D: Physical projection; E: Oral presentation

Question 6 was "If you were a teacher, how would you teach illustration?". The statistics on which way the teacher would teach the students in the classroom to facilitate their understanding are shown in Figure 6.

From Figure 6, it can be clearly seen that students have different degrees of preference for different teaching methods of teachers' illustrations. Total of more than 50% of the students wanted to study the illustrations by themselves first, and then took the initiative to complete the research on illustrations with the help of teachers or other students; while most of the remaining students wanted to read the illustrations under the teacher's lead by the teacher's explanation of the illustrations or after the request to the classmates. This was relatively passive, depriving the students of the opportunity to read the pictures, and was not conducive to the cultivation of the students' ability to read the illustrations. There were also a very small number of students who think that it was not necessary to carry out the teaching of textbook illustrations.

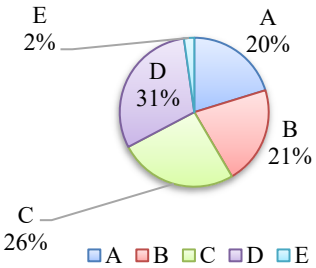

Figure 6. Statistics on the proportion of students who want illustrations to be taught in which way

*A: Study the picture thoroughly, then explain to the students; B: Put forward a request to guide students to understand the picture; C: Students read the picture in their own way, and then the students ask questions about the picture; D: Give students the opportunity to discuss the illustrations and then explain the illustrations by the students; E: Other

Question 7 was "Graphic questions occupy a certain proportion of various types of exercises and exams. How do you feel about doing such questions?". The statistics of students' self-perceptions when answering the graph-type questions are shown in Figure 7.

From Figure 7, we can find out the students' self-perceptions when they solve the graph-type questions. Most of the students thought they were at an average level; 13% of them thought that they were good at handling graph-type questions and are relatively comfortable with this type of questions; only 3% of the students thought that they were not good at such questions at all, and it was more difficult for them to understand the question, so they lose much marks in such questions. Graph-type questions have a certain proportion in all kinds of exams and exercises, which is an examination of students' ability to read pictures and is an ability that students must master.

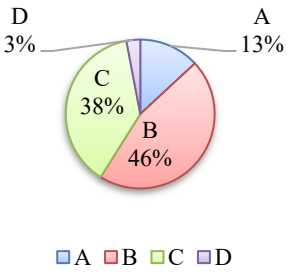

Figure 7. Statistics on the proportion of students with different self-perceptions of answering graph-type questions

*A: very good at it; B: relatively good at it; C: average; D: not good at it

Question 8 was about students' self-assessment on their mastery of illustrations. The question was "Which of the following statements do you think is consistent with your situation? (Multiple choice)", and the statistics are shown in Figure 8.

From Figure 8, it is easy to see the different situations of students' mastery of illustration. Most of the students had a relatively good grasp of the illustrations they had learned; however, nearly 30% of the students still did not know some of the illustrations they had learned; there were also more than 30% of the students who were familiar with the illustrations in the textbooks, and could independently analyze the information contained therein; only 15% of the students were proficient in the skills of reading pictures, and could solve illustration problems independently, both inside and outside the classroom.

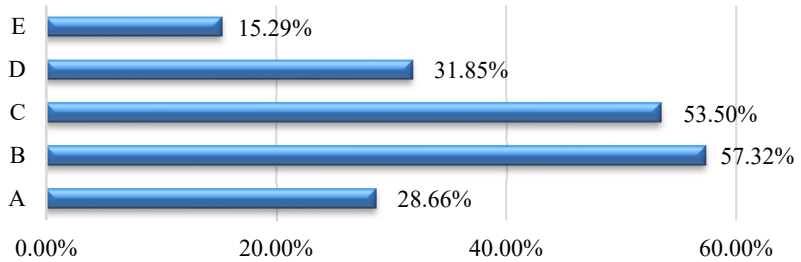

Figure 8. Statistics on the proportion of students with different mastery of illustrations

* A: I don't recognize some illustrations for what I have learned; B: I know the illustrations I have learned, but I cannot analyze the implicit information inherent in the illustrations; C: I can understand the illustrations in the book, but I can't understand the relevant variants in exams and exercises; D: Able to understand the content of the book illustrations without teacher's guidance; E: Can solve the illustrations independently regardless of the illustrations inside or outside the classroom

4. Conclusion and Recommendation

Through the questionnaire survey, we learned that students paid more than enough attention to the illustrations in the textbooks, but their use and mastery of illustrations were not enough. In general, students are only superficially concerned about the illustrations in science textbooks, and their ability to deal with illustration-type questions is insufficient. This requires teachers to teach students appropriate illustrations in the teaching process, and to give them necessary help in coping with illustration-type questions, improving their ability to read pictures more comprehensively.

Taking some illustrations in junior middle school science textbooks as examples, we propose the following three suggestions for improving illustration teaching.

(1) We can materialize abstract illustrations, connect specific things in reality, and connect dead knowledge of books with life, so that students can deepen their understanding of knowledges through familiar scenes.

For example, when studying the content of "conditions for burning" in chapter 3, section 2 of volume 2, grade 8, there is an illustration of "forest fire" in the textbook. We can let the students observe the contents of the illustration first, the easiest thing to observe is that this is a forest with a large number of trees, trees are obviously a material that can be burned. In science, the substances that can be burned are collectively referred to as combustibles, and combustibles are the first condition for combustion. Then it can be found that this is an open place, the air circulation is very convenient, and there is sufficient oxygen. Oxygen acts as a combustion aid here, and the combustion aid is the second condition for combustion. But there are many scenes that meet such conditions in daily life, but not all places will burn, because there is still a lack of conditions - the temperature reaches the ignition point, which is the third condition of burning. The second conditional combustion aid (oxygen) is difficult to observe, but can be deduced from some phenomena in life. The most typical one is honeycomb, which is cylindrical in shape, and there are small

cylinders running through the top and bottom, which are shaped like honeycombs, so it is called that. The small cylinder that runs through it is to increase the contact area with the air and facilitate the circulation of oxygen, which is also the reason why the fire should be hollow.

(2) We can simplify complex illustrations. Teachers can use the content in these complex illustrations to guide students to summarize the most essential features, so as to facilitate students' understanding of it.

For example, in chapter 1, section 5 of volume 1, grade 9, a complex illustration of the "essence of the reactions between acids and bases" is given. Teachers can first ask students to write the chemical equations of these 16 reactions, and guide students to observe how they are related. Students will find that they are all processes in which H^+ in acid and OH^- in base combine to form water, and the remaining anions and cations combine to form salts. This is the essence of the acid salt reaction, and a general formula can be used to express the meaning of this illustration (acid + base = salt + water), which simplifies the illustration by highlighting the key points and abbreviating the secondary points, easing the learning task for students.

(3) We can use experimental illustrations to develop students' observation ability and diverge students' thinking.

There are many illustrations of experimental devices and experimental phenomena in the textbook, and the situations in the illustrations can be reproduced by doing experiments, but teachers need to make certain preparations and expansions before and after the experiment. By interpreting the illustrations before the experiment, teachers let the students understand the principle of the experiment, the points to note in the experiment, the advantages of the experiment designed in this way, and whether the experiment can be improved, so that the experiment can be completed efficiently. When reviewing after the experiment, students can compare the illustrations, simulate the experiment, and recall the steps of the experiment to deepen their understanding of the experiment.

Effective use of illustrations in science teaching can not only develop students' ability to read and use pictures, but also open up students' horizons and inspire their thinking. We hope that illustration teaching will be better developed in the future and students' ability to read pictures will be improved.

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