HNUE JOURNAL OF SCIENCE DOI: 10.18173/2354-1075.2023-0086
Educational Sciences, 2023, Volume 68, Issue 4, pp. 86-98
This paper is available online at http://stdb.hnue.edu.vn

THE CURRENT SITUATION OF TEACHING AND LEARNING NATURAL SCIENCE IN SECONDARY SCHOOLS IN THUONG TIN DISTRICT, HANOI

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Abstract. In recent years, the number of studies on teaching and learning Natural Science in the 2018 General Education Curriculum has increased rapidly, however, the number of studies on the current situation of teaching and learning this subject in schools has been limited. To address this research gap, the article aims to analyze the current situation of teaching and learning Natural Science at secondary schools in Thuong Tin District, Hanoi. The article employs a mixed-research approach and convergent parallel mixed method design, which collects and analyzes 17 secondary data from 5 secondary schools, a survey by questionnaire with 60 school managers and teachers, and in-depth interviews with 10 school managers and 15 teachers. The research results show the current situation of teaching and learning activities in Natural Science in the following aspects: awareness of the importance of the subject, objectives and learning outcomes, curriculum and teaching and learning content, teaching and learning methods, teaching and learning forms, test and assessment of students' performance, facilities and equipment. Research results are significant in terms of adding new understanding about the current situation of teaching and learning Natural Science in secondary schools in different socio-economic contexts, contributing to implementing the 2018 General Education Curriculum successfully.

Keywords: teaching and learning activities, Natural Science, General Education Curriculum 2018.

1. Introduction

Natural Science is a subject implemented for the first time in the 2018 General Education Curriculum (GEC) at secondary schools. If Physics, Chemistry, and Biology are three separate subjects in the 2006 GEC, these three subjects along with the content of Earth Science are integrated into Natural Science in the 2018 GEC. Natural Science plays a significant role in helping students develop their qualities and competencies formed and developed at the primary school level; and enhance knowledge and foundational skills to continue studying in upper secondary school or vocational schools.

Since the implementation of the 2018 GEC, the number of studies on teaching and learning Natural Science has increased, demonstrating the great interest of the scientific community and presenting imperative needs from the practice of teaching innovation in schools. These studies can be divided into three main research streams. The first research stream is on designing lesson plans [1] or planning teaching and learning for a specific topic [2-4]. Also in this research stream, some authors explore the organization of teaching STEM, STEAM, or testing the flipped classroom model in teaching [5-7]. The second research stream is studies related to testing and assessment

Received July 20, 2023. Revised August 11, 2023. Accepted September 3, 2023.
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of the Natural Science subject according to a quality and competency development-oriented approach. In this stream, several studies focus on designing test and assessment frameworks or toolkits for assessing students' ability to learn Natural Science [8-11] while many other studies aim to develop types of exercises used in teaching to develop student capacity [12, 13]. The third research stream is general studies on the current situation of teaching and learning Natural Sciences [14, 15]. It can be said that although it is a newly emerging research topic in recent times, the number of research topics on teaching and learning Natural Science has been relatively large and diverse, contributing to building a theoretical foundation for the study of a new subject in secondary schools. However, while the first and second research streams have gained remarkable attention, the third research on the current situation of teaching and learning Natural Science in secondary schools is not fully understood. Therefore, this study was conducted to solve the research question "What are the advantages and limitations of teaching and learning natural science in secondary schools in Thuong Tin district, Hanoi city?". The study is meaningful in terms of adding new understandings about the current situation of teaching and learning Natural Science subjects in secondary schools in localities with different socio-economic contexts, contributing to improving the quality of teaching and learning Natural Science as well as implementing GEC 2018 successfully.

2. Content

2.1. Teaching and learning activities of Natural Science in secondary schools in the 2018 General Education Curriculum

Natural Science at the lower secondary level is delivered in Grades from 6 to 9, for a total of 140 periods per school year and 4 periods per week. This is an important subject for the comprehensive development of students, playing a fundamental role in the formation and development of the scientific worldview of secondary school students. Regarding the learning goals and outcomes, the subject contributes to developing general qualities, general competencies, and specific competencies identified in the 2018 GEC. Regarding the teaching and learning content, the Natural Science curriculum is built based on the combination of 3 basic axes: Scientific topics - General principles/concepts of science - Formation and development of students' competencies. Which, the general principles/concepts will be the cross-cutting issue, linking the scientific topics of the program. The main scientific topics of the subject are Substance and its change; Living Things; Energy and Transformation; Earth and Sky. Topics are mainly arranged in linear logic, combined to a certain extent with concentric structure, and at the same time, there are several interdisciplinary and integrated topics to form general principles and rules of the natural world [16].

In terms of teaching and learning methods, Natural Science employs active teaching and learning methods, in which teachers play the role of organizing and guiding activities for students, creating a friendly learning environment and challenging situations for students to actively participate in learning activities, practice habits, and self-study abilities, promote accumulated knowledge, skills and their potential through teaching and learning methods such as observation, investigation, lecture, and problem-discovering and solving, discussion, conversation, brainstorming, debate, practice, experiment, story-telling, role-playing, games.

Regarding the form of teaching and learning, depending on the specific learning objectives and the complexity of the learning activities, students can be organized in the following forms such as whole-class learning, learning in small groups, and individual learning. In addition, since the subject has many contents related to the natural environment, the forms of learning outside the classroom such as visiting production facilities, natural landscapes, and research institutes... can be also applied. For testing and assessment of student performance, the subject employs a variety of methods such as observation, question and answer, written tests, learning product

assessment, and portfolio assessment. Teaching and learning Natural Sciences also requires a system of facilities and teaching aids that is regulated by the Circulars of the Ministry of Education and Training.

2.2. Research Methods

This study employs a mixed qualitative and quantitative research approach, with a converging parallel mixed research method design, using a combination of data collection methods such as desk study, in-depth interviews, and a survey by questionnaire [17]. The research site is secondary schools in Thuong Tin district, Hanoi city since it is representative of education in suburb areas. With the desk study, the authors collected a total of 17 documents from 5 schools including plans (annual and monthly activity plans of the schools; educational plans of professional groups; individual educational plans; lesson plans; individual plans), school year-end reports... These schools are selected in convenience and their identity is hidden for research ethics reasons. Then secondary data is reviewed, filtered, and sorted into content related to the identified theoretical framework. With the in-depth interview method, the authors interviewed 10 school managers and 15 teachers who are teaching Natural Science at schools. An interview protocol covers key elements of the theoretical framework to keep the interview process focused on the research topic. Interview participants were sent a set of interview questions in advance to have an idea of the research topic and increase the richness of qualitative data. Qualitative data is processed by open code to emerge main themes. With the survey method by questionnaire, the authors surveyed 60 school managers and Natural Science teachers who were randomly selected from 5 participating schools. The aggregated answer data from Google Forms is exported to an Excel table to calculate and perform descriptive statistics. Response results are averaged and interpreted by their average score (1.00 - 1.75: Weak; 1.76 - 2.49: Average; 2.50 - 3.24: Good; 3.25 - 4.00: Very Good). The data are cross-checked to check the reliability of the research results. During data collection and analysis, researchers applied triangulation to develop a fully comprehensive understanding of the research questions.

2.3. Results and Discussion

2.3.1. The current situation of awareness of school managers and teachers about the role and importance of teaching and learning Natural Science at secondary schools in Thuong Tin district, Hanoi

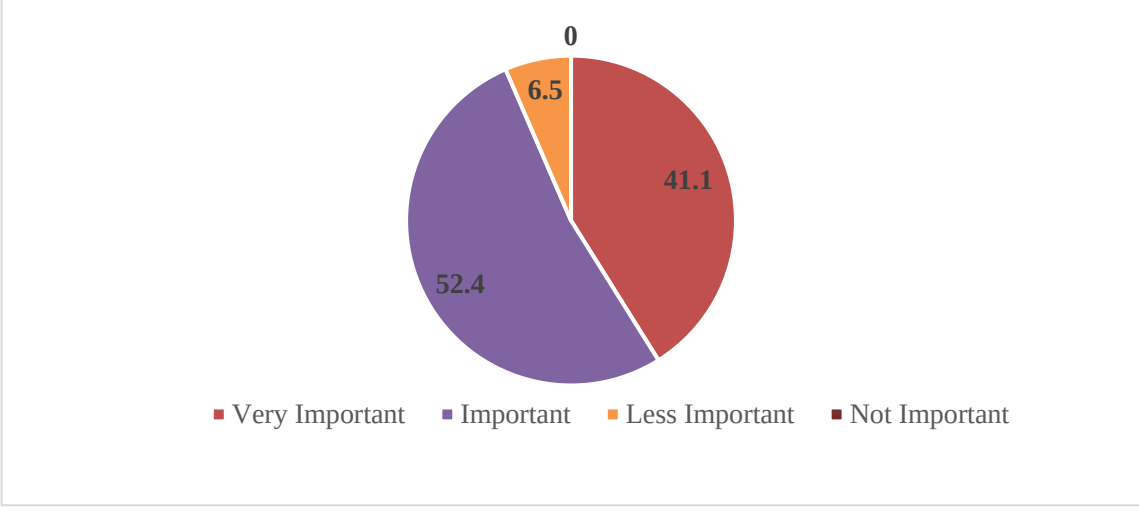

Figure 1. Responses of school managers and teachers about the importance of teaching and learning Natural Science

The chart above shows that the majority of administrators and teachers think that teaching and learning Natural Science is important (41.1% very important, 52.4% important). This result is in agreement with the interview data. Teacher GV01 believes that Natural Science in the 2018 GEC is an important subject for students because it is a compulsory subject developed based on Physics, Chemistry, Biology, and Earth Science. It helps students achieve common qualities and competencies as well as particular competencies. Teacher GV23 added: "*The school principal and the teacher leader of my professional group often remind Natural Science teachers to prepare lessons, equipment, and teaching aids to make the lesson the most effective because this subject now has the same number of periods as Literature and Mathematics. It plays an important role in the new education curriculum*". However, 6.5% of teachers maintained that Natural Science is less important. According to GV17: "*Three subjects of Physics, Chemistry, and Biology have also provided enough knowledge for students. If these subjects are combined with interdisciplinary teaching and learning, STEM, topic-based teaching, and new teaching and learning methods and forms, teaching and learning a new subject as Natural Science is not necessary".* It can be seen that these teachers do not fully understand the characteristics and importance of Natural Science in the new GEC and still support teaching and learning three subjects separately as previously.

2.3.2. The current situation of implementing learning outcomes of Natural Science at secondary schools in Thuong Tin district, Hanoi

The results of the assessment of implementing learning outcomes of Natural Science show that all respondents agree with a Good level of performance and the average score ranging from 2.63 to 3.03.

Table 1. Responses of school managers and teachers on implementing learning outcomes of Natural Science subject at secondary schools in Thuong Tin district, Hanoi

No.	Learning outcomes	Mean	Level of performance	Ranking
	Key qualities			
1	To form and develop the following qualities: patriotism, compassion, hard work, honesty, and responsibility.	2.87	Good	5
2	To form and develop a scientific worldview.	2.63	Good	8
3	To educate the qualities of confidence, honesty, objectivity, love of nature, respect, and know how to apply the rules of nature.	2.75	Good	7
	General competencies			
4	To form and develop general competencies for students: autonomy and self-study, communication and cooperation, problem-solving and creativity.	2.88	Good	4
5	To form and develop other competencies such as language ability, computing capacity, technological capacity, and digital capacity; contributing to the development of lifelong learning capacity.	2.87	Good	5
	Specific competencies			
6	To form and develop the cognitive ability of natural sciences.	3.03	Good	1

No.	Learning outcomes	Mean	Level of performance	Ranking
7	To form and develop the ability to learn about nature.	2.93	Good	3
8	To form and develop the ability to apply knowledge and skills learned.	3.01	Good	2

- The item *"Learning outcomes on specific competencies*" is assessed to gain the highest performance with the average score from 2.93 to 3.03 points. This result is consistent with the desk-study data from the teacher's lesson plan. Specifically, when designing the teaching and learning content in the lesson plan, teachers usually pay more attention to knowledge and skills closely related to the natural science subject. The teacher interview data is also quite similar. Teacher GV13 said: "*We have higher motivation and in-depth professional knowledge of the specific competencies of natural science subjects, so we can communicate and form the cognitive capacity of natural sciences to students more effectively*".

- The item *"Learning outcomes on general competencies*" gained an average score of 2.87 - 2.88 points. From interview data, most teachers think that these learning outcomes play a vital role in the comprehensive development of students and equip them with essential knowledge, skills, and qualities for their lives. However, as these learning outcomes are formed and developed through all other subjects and educational activities, teachers will place these learning outcomes with less priority than learning outcomes of specific competencies.

- The item *"Learning outcomes on key qualities*" is assessed as least effective, but the average score is still at the Good level from 2.63 to 2.83 points, in which "*To form and develop of scientific worldview*" has the lowest average score (Mean 2.63). This result is also consistent with interview data. Specifically, teachers reflected that the learning outcomes *were* "*To form and develop the qualities: patriotism, kindness, hard work, honesty, responsibility*" and "*To educate the qualities of confidence, honesty, objectivity, love of nature, respect and know how to apply the rules of nature*" has been implemented since the 2006 GEC, therefore teaching and learning these learning outcomes are more effective. For the learning outcome "*To form and develop a scientific worldview"*, although teachers have begun to pay attention to, teaching and learning results have not been as expected. Teacher GV01 said: "*The formation of a scientific worldview will help students master an important tool to recognize, analyze, and properly solve the problems posed by learning and practice. However, we have not been trained in this content professionally, so we face challenges in understanding and practicing this learning outcome in the teaching process*."

In summary, the implementation of the goals of teaching and learning Natural Science in schools has met the demand of the 2018 GEC. However, the effectiveness of the learning outcomes on developing general qualities and competencies is not high due to teaching and learning Natural Science still putting a strong emphasis on teaching knowledge and forming specific competencies of the subject.

2.3.3. The current situation of implementing curriculum and learning contents of Natural Science at secondary schools in Thuong Tin district, Hanoi

Through interview data, school managers and teachers reported that their schools do not develop school curricula by themselves, but the curriculum and teaching and learning plans for subjects are developed by the district Bureau of Education and Training and applied uniformly for all secondary schools in the district. CBQL01 explained that when the Bureau applies one educational plan for the whole district, it will help schools to make planning easier and teachers from different schools will also have more advantages in exchanging professional issues.

However, the authors argue that this approach might cause some limitations because it is not consistent with the requirement of 2018the GEC to increase the autonomy of schools, for example, schools are not allowed to change the number of periods of the learning content to match with school conditions. Teacher GV03 said: "*For the learning content about Discovering creatures in the wild, according to the GEC, we have to organize teaching and learning activities outside the classroom, but due to the difficulties of time and place, the activity can only be organized in 2 or 3 periods. However, according to the Bureau's educational plan, this content must be organized in 4 periods. This plan makes it difficult for us to implement".*

Regarding learning contents of Natural Science at schools, the survey results show that most respondents agree with a Good level of performance and the average score ranging from 2.71 to 2.86.

Table 2. Responses of school managers and teachers on the implementation of the learning content of Natural Science at secondary schools in Thuong Tin district, Hanoi

No.	Learning content	Mean	Level of performance	Ranking
1	Learning content is reasonably designed	2.86	Good	1
2	Learning content is differentiated	2.78	Good	3
3	Learning content is associated with practice	2.82	Good	2
4	Learning content is suitable for students' capacity	2.71	Good	4

- The item "*Learning content is reasonably designed*" gained the highest level of performance (Mean 2.86). Through studying the educational plans of the professional groups, educational plans, and lesson plans of teachers, the authors found that learning contents are clearly defined by teachers, especially core teaching and learning activities to help students gain knowledge. The four main scientific topics of the GEC are mainly arranged in linear logic, and there are some interdisciplinary, integrated topics to form general principles and rules of the natural world, for example, in GV23's lesson plan for the topic "Exploring the ocean" to learn about the influence of water resistance on the life of aquatic animals; in GV14's lesson plan the topic "I'm an environmentalist" integrates the lesson on Biodiversity from Natural Science with the lesson on Responding to climate change from Experiential activities.

- The item "*Learning content is associated with practice*" gained the second performance level (Mean 2.82). A teacher GV11 of school B explained that linking teaching and learning contents and activities with practice is only performed during periods within contests for good teachers. In addition, all teachers have been trained for the certificate of teaching Natural Science, but due to the short training time, they still need to self-study for further knowledge of the subject. Therefore, it is still not flexible to connect the content of natural science subjects to reality.

- The item "*Learning content is differentiated"* ranked in the third position (Mean 2.78). From interview data, GV12 said: "*For the first year of implementing Natural Science subject for grade 6, we had to apply online learning form. Thus, we encountered difficulties in differentiating learning contents for each target group of students"*. Teacher GV15 added: "*In order to classify students well, it is necessary to rely on the student's learning performance and assessment results. However, we have not been fully trained in this topic and we have to teach online for a long time. Therefore, the differentiation of learning contents of Natural Science subject is not very effective"*.

- The item that is evaluated and implemented at the last ranking is "*Learning content is suitable for students' capacity*" (Mean 2.71). This result can be explained through desk-study data from teachers' lesson plans. Specifically, some teaching and learning contents and methods are not suitable for the characteristics, capacity, and actual conditions of students, leading to an

overwhelming for students. For example, the topic "Oxygen - Air" is designed to be taught in 4 periods. Because there are many learning content and goals to be achieved, teachers often design this theme with 8 activities and apply many teaching and learning methods such as discussion, question and answer, brainstorming, experiments, and games... Therefore students have difficulty understanding and adapting to different learning activities.

In summary, the implementation of learning contents of Natural Science at the secondary schools of Thuong Tin district was assessed as Good level, but the average score was not high. The learning content has been reasonably designed according to linear logic, but the number of periods for each lesson is not reasonable for some schools. In addition, as teachers have only received short-term training certificates, they have difficulties in designing learning content linked to practice, differentiated and suitable for students.

2.3.4. The current situation of using teaching and learning methods of Natural Science at secondary schools in Thuong Tin district, Hanoi

Table 3. Responses of school managers and teachers on the current situation of using teaching and learning methods of Natural Science at secondary schools in Thuong Tin district, Hanoi

No.	Teaching and learning methods	Mean	Level of performance	Ranking
1	Observation method	3.06	Good	4
2	Investigation method	2.87	Good	10
3	Lecture method	3.19	Good	2
4	Problem-solving method	3.14	Good	3
5	Brainstorming method	2.97	Good	6
6	Question and answer method	3.04	Good	5
7	Discussion method	3.33	Very good	1
8	Debate method	2.93	Good	7
9	Practice method	2.91	Good	9
10	Experimental method	2.92	Good	8
11	Storytelling method	2.27	Average	12
12	Role-playing method	2.25	Average	13
13	Game method	2.58	Good	11

The data shows that schools have implemented many different methods in teaching and learning Natural Science and the achieved results vary widely from average to very good level.

- Teaching and learning methods that are evaluated to perform the best are the discussion method (Mean 3.33); lecture method (Mean 3.19); problem-solving method (Mean 3,14). This result is also consistent with the data from investigating teachers' lesson plans. From interview data, most teachers believe that these are traditional methods, easy to implement with all class sizes, and short preparation time, therefore teachers often apply them to teach Natural Science.

- Teaching and learning methods like observation (Mean 3.06); question and answer (Mean 3.04), brainstorming method (Mean 2.97), debate method (Mean 2.93), experiment method (Mean

2.92), and practice method (Mean 2.91) have a lower average score but is still quite high. This result is in agreement with the data from the interview. Teacher GV17 at school B reported that although Natural Science is a new subject, the teaching and learning to develop students' competencies has been implemented for a long time. Therefore, teachers often use active teaching and learning methods. However, the use of these methods is not very effective and some methods are not suitable for the content of teaching natural science, she added.

- Teaching and learning methods that received the lowest rating for performance are the game method (Mean 2.58); storytelling method (Mean 2.27), and role-playing method (Mean 2.25). From desk-study data, the teachers' lesson plan shows that this result is appropriate. The method of using learning games with content associated with students' learning activities requires teachers to prepare many contents and learning materials. Many teachers are also confused when employing this method since it requires game organizing and facilitation skills. For the storytelling and role-playing methods, it depends a lot on the knowledge and skills of the students while it is quite difficult for those in suburban areas like Thuong Tin district since only a few students receive training in these skills. Through interview data, GV06 said that these two teaching methods are based on assigning learners to solve a specific situation through storytelling or role-playing, which requires Natural Science teachers to actively learn the content be creative following the lesson, and spend a lot of time writing a full teaching and learning process. This is a major difficulty because teachers are used to focusing on the formation of knowledge rather than focusing on the formation of qualities and competencies.

In summary, at secondary schools in the Thuong Tin district, teachers have made certain efforts to apply a variety of teaching and learning methods suitable to the learning content, but the effectiveness of the methods is not high. Teachers often focus on using traditional methods that are easy to implement and rarely use active and practical teaching and learning methods.

2.3.5. The current situation of using forms of teaching and learning Natural Science at secondary schools in Thuong Tin district, Hanoi

Table 4. Responses of school managers and teachers to the current situation of using forms of teaching and learning Natural Science at secondary schools in Thuong Tin district, Hanoi

No.	Teaching and learning forms	Mean	Level of performance	Ranking
1	Learning in the whole class	3.10	Good	1
2	Learning in small groups	3.04	Good	2
3	Individual learning	2.80	Good	3
4	Learning outside the classroom	2.71	Good	4
5	Visiting scientific facilities, production facilities	2.35	Average	5

The forms of teaching and learning natural science in the secondary schools of Thuong Tin district are quite diverse, however, they have not focused on specific forms suitable for natural science subjects. The results of the implementation of the forms are mainly assessed at the Good level, in which:

- The items *learning in the whole class* (Mean 3.10) and *learning* in s*mall groups* (Mean 3.04) are highly appreciated because these forms are popular and easy to apply, and teachers have a lot of experience in implementing them. For example, for the lesson "Oxygen - Air", GV08 designed the lesson as follows: Activity 1 (Learning oxygen on Earth) and Activity 2 (Learning the physical properties of oxygen) using the whole-class form; Activity 3 (Learning the importance of oxygen) and Activity 4 (Learning about the composition of the air) using group

form, Activity 5 (Learning the role of the air) using the whole class form. GV09 designed the lesson "*The moon*" as follows: Group form for Activity 1 (Learning about the moon and its observable shape) and the whole class form for Activity 2 (Explaining about the moon and its different observable shapes of the moon - phases of the moon).

- The form of individual learning (Mean 2.80) has gained the second performance level. This result can be interpreted from the interview data. Teacher GV11 said: "*Individual learning is a form that teachers assign work to each student, encouraging them to actively work and discover knowledge by themselves. We only use this form when students have difficulty in learning. However, teaching each student will take a lot of time, affecting the lesson's content*".

- The most limited group of teaching and learning forms is *learning outside the classroom* (Mean 2.71 points) and *visiting scientific facilities and production facilities* (Mean 2.35). This result is quite consistent with desk-study data of school reports. Out of the 5 schools, only one school organized a tour for students to visit the production facility, however, it was only done once in a school year. Teacher GV03 explained that: *"Currently, due to limitations in some aspects, the forms of learning outside the classroom (i.e. extra-curricular, experiential learning), visiting production facilities, and scientific facilities have not been available yet. Consequently, teaching and learning Natural Science in schools has low effectiveness and is not associated with life. The schools do not take advantage of the coordination and available conditions of the local community to facilitate teaching and learning Natural Sciences".* Teachers also added that applying this form of teaching and learning is difficult in terms of time (it is impossible to conduct an experiential activity within a school period), in field trip organization (industrial parks and farms are quite far from schools, so a certain amount of funding is required for activities.

In short, schools successfully implement forms of learning in the whole class, learning in small groups, and individual learning. However, the form of learning outside the class and visiting scientific and production facilities has not been implemented widely due to constraints of time, space, and cost.

2.3.6. The current situation of testing and assessment of student performance in Natural Science at secondary schools in Thuong Tin district, Hanoi

Table 5. Responses of school managers and teachers to testing and assessing student performance in Natural Science at secondary schools in Thuong Tin district, Hanoi

No.	Methods of testing and assessing student performance	Mean	Level of performance	Ranking
1	Observation	2.80	Good	3
2	Question and answer	2.86	Good	2
3	Written test (paper-based or computer-based)	3.05	Good	1
4	Evaluation of student's learning products (equipment, models, videos, posters, journals, drawings...)	2.69	Good	4
5	Evaluation of student's portfolio	2.50	Good	5

The above data shows that testing and assessment of student performance are performed at a Good level with the average score ranging from 2.65 to 3.05 points. In there:

- The item "*Writing test (paper-based or computer-based)"* has the highest average score of 3.05 points. From investigating teachers' lesson plans, it is found that most teachers still use paper-based tests when teaching face-to-face and computer-based tests when teaching online for 15-minute tests, mid-term exams, and end-term exams. Which, about 15 teachers gave exercises

that required students to observe pictures and present content, use study cards, or ask students to write essays. In addition, some teachers also design assessment sheets for students to self-assess and evaluate each other.

- The form *question and answer* gained the second ranking (Mean 2.86), it is observed that in the lesson plan, teachers usually prepare a list of questions for each section and predict students' answers. Teacher GV10 explained: "*We use the question and answer method the most and have the highest efficiency because we don't spend a lot of time thinking up and asking questions for students, then we will also get respond very quickly to the student's answer. This helps us to adjust our teaching activities as well as have the opportunity to support each student*". However, some teachers argue that this method wastes time and negatively affects the lesson plan. If teachers are not skillful, they can not be able to attract the whole class but only maintain small dialogues between the teacher and student.

- For the third-ranking "*Observation"* (Mean 2.80), teacher GV18 explained: "*The Natural Science requires us to organize learning activities in which students are the active subject, such as designing cell model products or writing journal on animal diversity. We can evaluate students through their presentation of these products or report on the performance of project tasks and practice with observation sheets. But it will take time to design the observation sheet and this method is subjective by the teacher*". Teacher GV15 also added: "*Last year I taught online so observation was limited. This method is more effective when we teach face-to-face because I can move around the class and listen to the conversations and discussions of students*".

- The item "*Evaluating learning products (equipment, models, videos, posters, journals, paintings...)"* gained the fourth-ranking (Mean 2.69). From investigating the lesson plans, it is found that only about 15 teachers employ this assessment method, for example, teacher GV05 evaluates the product "Making a mini water purifier" after learning the topic "Separating substances from the mixture" in Grade 6, teacher GV17 designed the journal "Energy with sustainable development" after completing the topic "Force" and the topic "Energy". In addition, this result can be explained from the interview data. Specifically, teacher GV02 said: "*Writing tests are more used by us because we have more experience and better training in this method. For assessing student learning products, we are only trained on some topics. Thus, to apply this method to other ones, we need more time to study. In addition, we also need to design a lot of tools to evaluate student's learning product*".

- With *the assessment of portfolio* (Mean 2.50), the desk-study data shows that only 03 teachers used this method to evaluate the student's learning results. Teacher GV04 explained: "*Evaluating student performance through learning portfolio supports us very well in assessment activities, especially in the context of implementing the new GEC, such as providing consistent and relevant information on student's progress throughout the learning process and allowing them to actively participate in the assessment process. However, this method needs to be implemented continuously throughout the student's learning process, so it takes a lot of time for both the development and evaluation stages. To be successful, we need a specific plan and careful preparation for this method. As Natural Science is a new subject, we have not received any specific orientation or guidance for the implementation of this method from the school or education agencies, so it is difficult for us to implement this method"*

In summary, teachers have used a combination of methods when testing and evaluating student performance. The traditional methods such as written tests, question and answer, or observation are performed more frequently and effectively; while the methods of assessing student's learning products and assessing student's portfolios have only been implemented by some teachers due to limitations of time, teacher's capacity, and preparation experience.

2.3.7. The current situation of facilities and teaching aids for teaching and learning Natural Science at secondary schools in Thuong Tin district, Hanoi

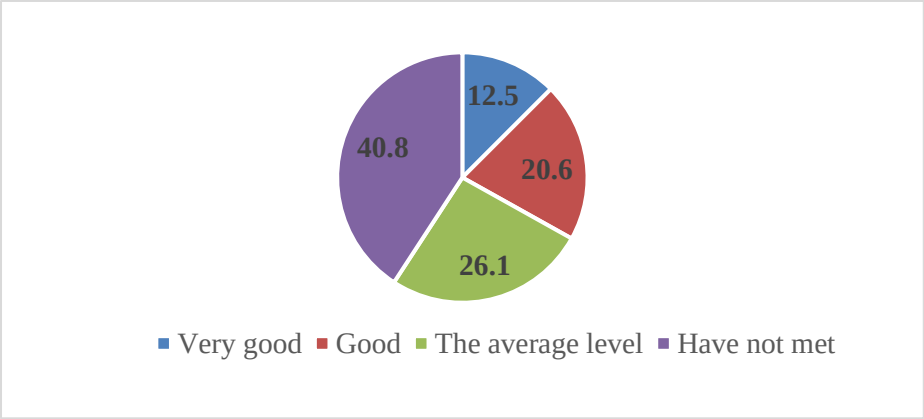

Figure 2. Responses of school managers and teachers to the responsiveness of facilities and teaching aids for teaching and learning Natural Science at secondary schools in Thuong Tin district, Hanoi

The chart above shows the responsiveness of current facilities and conditions for teaching and learning Natural Science in schools is still limited. Responses at the very good and good level only account for 33.1%, the average level is about 26.1%, while the remaining 40.8% of respondents assessed the facilities and conditions have not been met for teaching and learning Natural Science at schools. This survey result can be explained by desk study data. Firstly, subject classrooms for Natural Science are established by merging Physics, Chemistry, and Biology classrooms. In general, the number of classrooms is guaranteed according to Circular 13/2020/TT-BGDĐT dated May 26 2020 of the Ministry of Education and Training regulated facilities standards and teaching aids for preschools, primary schools, and secondary schools. However, at School B and School C, since there is a lack of classrooms, sometimes the schools had to use Natural Science classrooms as normal classrooms for students. Secondly, at all schools, it is difficult to arrange the timetable for each teaching and learning content of each subject of Natural Sciences for Grades 6 and 7 in the 2018 GEC while arranging the timetable for Physics, Chemistry, and Biology for Grades 8 and 9 in the 2006 GEC. Third, some specialized teaching aids and equipment are not enough following the provisions of Circular No. 14/2020/TT-BGDDT dated May 26 2020 of the Ministry of Education and Training on subject classrooms of general education institutions. For example: at School D, there is no specialized wash basin, faucet system, and electrical system; At school C, there are no exhaust passages for gases, odors, and toxic vapors. In addition, this result is also explained from the interview data. Specifically, teacher GV05 said: "*In addition to designing new sets of experiments, the teachers at my school used the teaching aids of Physics, Chemistry, and Biology in the 2006 GEC for teaching Natural Science in the 2018 GEC. However, as the equipment has been purchased for a long time, many devices are damaged and cannot be used* ".

In summary, the facilities and teaching aids for teaching and learning Natural Science at secondary schools in Thuong Tin district, Hanoi are still limited. All schools have subject classrooms but they have to use in parallel between teaching Physics, Chemistry, and Biology for students in Grades 8 and 9 and teaching Natural Science for students in Grades 6 and 7. Besides, specialized equipment has not been designed appropriately for teaching and learning Natural Science and some teaching aids are not sufficient and diverse to meet the demand of teaching and learning.

3. Conclusion

After 2 years of implementing Natural Science in the GEC 2018, secondary schools in Thuong Tin district have initially achieved positive results as most teachers perceive clearly the importance of the subject in the new curriculum; teachers have accomplished the goals and learning outcomes in terms of developing specific competencies; professional teacher groups have designed reasonable learning content; teachers have initially applied active teaching and learning methods towards promoting student's activeness. However, since Natural Science is a new subject in the program, schools and teachers still face some difficulties and limitations when teaching and learning, such as the schools having limited autonomy in developing school curricula but applying a unified curricula throughout the district; teachers still focus on teaching knowledge instead of developing student's qualities and competencies; learning content is not closely associated with the practice, and low differentiation; many teachers still tend to provide too much learning content, causing students to overload; the teaching methods used are not diverse and some methods are still ineffective; the forms of teaching and learning still focus on learning in the whole class and learning in small groups, while forms such as individual learning, learning outside the classroom, visiting scientific facilities; the forms of testing and evaluation of student's performance are less diverse, the system of facilities and teaching aids has not yet met the demand of teaching and learning. This current situation requires schools to improve their autonomy in managing teaching activities, encouraging initiatives to transform from content-based teaching and learning to qualities and competencies-based teaching and learning. Besides, teachers need to develop their professionalism to innovate and improve the quality of teaching and learning.

REFERENCES

[1] Le, T. P., 2021. "Designing Biological Topics in Teaching Natural Science of Grade 6 according to the 2018 General Education Curriculum to Improve the Quality of Teaching and Learning". *Journal of Science: Educational Research*, 37(2), 61-69.

[2] Nguyen, D. H., 2022. "Organizing experiential activities in teaching the topic "The Earth and Ky" in Grade 6 of Natural Science according to the competency development-based approach". *Journal of Education*, 22(5), 37-41.

[3] Nguyen, T. M.C., 2021. *Building and using teaching aids to teach the topic "Energy and life" in teaching Natural Science 6*, Master's Thesis, University of Education Hanoi.

[4] Nguyen, T. A. T, & Hoang, T. H. Y., 2020. "Developing lesson plan by topics for teaching Natural Science according to the competency development-based approach". *Education Journal* No. 480, 31-35.

[5] Duong, T. T., 2021. *Organization of teaching STEM topic "The Earth and Sky" in Grade 6 of Natural Science to develop student's natural science competency*. Master's Thesis, Hanoi University of Education.

[6] Pham, C. T., 2021. *Developing self-study capacity through teaching Grade 6 of Natural Science according to the flipped classroom model*. Master Thesis, Hanoi National University of Education.

[7] Nguyen, T. N., & Truong, T. M. T., 2021. "Organizing Steam experience activities in teaching the content "Energy and transformation" in Grade 8 of Natural Science". *Journal of Educational Equipment*, 242(1), 10-12.

[8] Pham, D. V., & Le, T. M. L., 2022. "Design framework for checking and assessing scientific research capacity in learning Natural Science of secondary school students". *Hochiminh City University of Education Journal of Science*, 19(2), 240-250.

[9] Nguyen, V. H., & Nguyen, T.A.T., 2021. "Formative assessment in designing lesson plans for Natural Science in secondary schools". *Education Journal*, 496(2), 29–34.

[10] Le, T. H., & Nguyen, T. P. V, 2020. "Proposing a framework for assessing natural science competencies for 6th-grade students in Natural Science to the new General Education Curriculum". *Journal of Education*, No. 483, 44-49.

[11] Nguyen, T. D. H, & Cao, C. G., 2020. "Some types of exercises to assess natural science competencies for secondary school students according to PISA approach". *Vietnam Educational Science Journal*, No. September 2020, 35-42.

[12] Pham, T. H. T, & Ha, T. H., 2020. "Using case studies to develop students' ability to apply knowledge and skills in teaching Natural Science". *Education Journal*, Issue 500 April, 11-15.

[13] Cao, C. G., & Nguyen, C. C., 2021. "Developing exercises to develop natural science competencies for secondary school students in learning Natural Science". *Teaching and Learning Today*, No. 1 April, 41-43.

[14] Pham, T. K. H., 2020. "Teaching Natural Science to STEM education in secondary schools". *Journal of Educational Equipment*, No. 230, 153-155.

[15] Le, T. C. T., & Le, P. N., 2021. "Evaluation of the current situation of teaching Natural Science in secondary school". *Journal of Educational Equipment*, No. 242 June, 116-118.

[16] Ministry of Education and Training, 2018. Circular 32/2018/TT-BGDDT on promulgating the General Education Curriculum, Hanoi.

[17] Creswell, J. W., 2013. *Qualitative inquiry and research design* (3rd ed.), Sage.