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Science Teachers' Views on Seasons and Climate Unit

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ABSTRACT

The seasons and climate unit, which is a unit requiring an interdisciplinary approach within the scope of the science course, is covered within the scope of the 8th grade middle school science course according to the recent change in the science curriculum. Within the scope of the study, we aimed to determine science teachers' views on the seasons and climate unit in terms of teacher readiness. Descriptive analysis, one of the qualitative research methods, was preferred in the research process. During the process, semistructured interviews were conducted with 22 volunteer science teachers and the data obtained was coded by two different people. While coding, a process in the target-objective-implementation plane was taken into consideration. As a result of the study, it was concluded that the place of the seasons and climate unit in the curriculum was found appropriate by the teachers, the fact that there were teachers who did not receive any training on this subject during their undergraduate education revealed misconceptions in the teaching of the subject, the subject was understandable by the students, the learning level of the students was tried to increase with modelling and experimentation, and the use of educational materials other than the textbook was emphasized. Findings of the study implicate that focusing on in-service training of teachers will be beneficial for teachers to use different teaching methods and techniques in their lessons.

Keywords: seasons, climate, science, measurement, assessment

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INTRODUCTION

The great civilizations of the world (Indian, Chinese and Mesopotamia) were founded on fertile lands and near water sources. Although ease of transportation and trade are reasons for this, the main reason is the suitability of climatic conditions. Even in today's conditions where technological opportunities are widespread, people prefer areas with favourable climatic conditions. The great scientist Ibn Khaldun's saying "geography is destiny" actually describes the fact that "geography is not destiny, but the future and civilization" (Şahin & Belge, 2016). Landforms, climate characteristics, vegetation, water and soil characteristics are the main natural environment features.

People need to recognize natural environments, shape their daily activities and long-term plans (settlement, transportation, trade, tourism, education, etc.) accordingly, and make this a norm of life. The most permanent way to gain this norm and make people acquire it is through education. Therefore, individuals need to undergo the necessary geography education appropriate for their level from an early age and gain the skills they should have by age. A good geography education helps individuals to adapt to different geographical conditions in the best way and connects individuals to life. The desire of people to recognize the natural environment in which they live, their need for nature and their labour to improve their living conditions by using what they have learned shows how important the science of geography is (Akbaş, 2021). The importance of this science in human life can only be ensured by providing sufficient geography education.

Geography education has been given in all countries in the world and in our country for many years. Especially in the current century, the importance of geography education is increasing even more. Considering the importance of the geopolitical position of our country, the basic level of geography knowledge that our citizens should have increases the importance of geography education even more. Thanks to a good geography education, individuals gain competencies such as recognizing the environment they live in, being aware of the advantages and disadvantages provided by this environment, recognizing environmental problems and producing solutions to these problems (Kaya, 2013).

In Turkey, geography topics are included in life science, social studies and science courses in basic education (Bahar, et al, 2018; Kızılçaoğlu, 2006; MoNE, 2018a, 2018b, 2018c, 2018d). Starting from the 9th grade of secondary education, topics are covered in depth in the geography course (MoNE, 2018d). In addition, science subjects are given to students from the 3rd grade of primary school and include not only physics, chemistry and biology but also geography, metallurgy, meteorology and space sciences. At this point, it is important to train teachers with an interdisciplinary perspective (Çeken, 2020).

The seasons and climate unit in the science curriculum is directly related to the geography course. However, since this subject was not included in previous science programs, it has been revealed in studies that teacher competencies in this subject are limited and misconceptions exist (Özcan et al., 2018; Semercioğlu et al., 2019). This situation is also valid for students, and it has been determined that students prefer to stay within stereotypes, have difficulty in

presenting different perspectives, and have misconceptions especially about the position and movements of the Earth in space (Alkış, 2013; Bolat & Altınbaş, 2018; Boz, 2019; Özcan & Birgin, 2021; Özdemir et al., 2010; Sneider et al, 2011). In-depth analysis on these issues will enable the identification of points that need to be corrected, especially in the content and process.

Within the scope of the study, it is aimed to determine the views of science teachers on the seasons and climate unit. The study also has sub-objectives regarding teachers' readiness, the place and appropriateness of the subject in the program, the acquisition of the gains in the process, the misconceptions, appropriateness of textbooks and auxiliary resources and their competencies in terms of measurement and evaluation.

METHOD

Within the scope of the research, qualitative research methods were adopted due to the purpose, the study group and the way the data were collected. Qualitative research is defined as the process of making sense of human-related problems by questioning them with unique methods while taking place in the natural environment of social life (Creswell, 1998). Within the scope of the study, analyses of common experiences and experiences related to a phenomenon were discussed. A phenomenological pattern is a pattern that reveals the common meaning of the lived experiences of several people regarding a phenomenon or a certain concept (Creswell, 2018). In this process, the views of individuals were trialled to be revealed with the phenomenological design, one of the qualitative research methods.

Participants

In the study, 22 volunteer science teachers with different experiences and working in different types of schools were interviewed, with teachers with master's and doctorate degrees in the field of science being prioritized as the study group.

Table 1. Demographic Characteristics of Participants

Seniority Year	**Education level**		
	Bachelor Degree	**Master's Degree**	**PhD**
6-10 years	4	1	2
11-15 years	1	2	2
16-20 years	4	3	1
21 years and over	1	1	

Data Collection and Analysis

According to the literature review conducted within the scope of the study, a semi-structured interview form consisting of 8 questions was developed. The interview form was presented to

7 experts in the field to ensure content validity and adjustments were made according to the feedback received. While determining the experts, it was prioritised that they had conducted studies in this field. In this context, for example, for question one, after the statement "Have you taken a course related to the "Seasons and Climate" unit during your undergraduate education?", the question was updated by adding the statement "How is the compatibility of this subject content with the courses you have taken?". The final version of the questions in the form is presented below and the purpose of the questions is given.

Table 2. Interview Questions and Objectives

Interview Questions	**Target**
1. Did you take a course related to the unit "Seasons and Climate" during your undergraduate education? How is the compatibility of this subject content with the courses you have taken?	readiness, level of knowledge
2. Is it appropriate to include the subject of seasons and climate in the 8th grade science curriculum? Why?	Is the outcome and content matching the right grade level and the right course?
3. Do you think that the learning outcomes for this unit are learned sufficiently by the students? Why?	whether the acquisition is sufficiently grasped or not
4. If there are extra practices you did during the unit, write why you chose these practices.	developing and using activities for course content
5. Do you find the textbook sufficient in terms of content etc. for this unit? Why?	compatibility of course materials with learning outcomes
6. Apart from the textbook, do you use digital resources related to this unit? If yes, please write the digital resources you use.	access to different resources
7. Are there any misconceptions you have identified about this unit? If so, write them down.	Determination of misconceptions (If any)
8. Evaluate the appropriateness of the questions related to this unit in the textbook or the auxiliary resources you use, such as the appropriateness of the outcome and the appropriateness for the student.	appropriateness of textbooks and auxiliary resources

After organizing the interview form, interviews were conducted with 22 science teachers. Of these, 7 were interviewed via online platforms and 15 were interviewed face-to-face. The interviews were recorded with the consent of the participant. After data collection, the data obtained from the interviews were coded by 2 different people (researchers). While coding, codes, categories and themes were created by considering a process of operation at the goalobjective-implementation level. For example, for question 2, a teacher answered "I think that the topics related to space and earth should be covered in the science course...". This answer was coded as "topics related to space and earth" and "being related to the subject area". The percentage of agreement between the coding was examined and found to be 92%. In order to

determine the compatibility between the codes, the percentage was calculated by dividing the number of common codes by the total number of codes. Agreement above 85% is considered reliable (Miles et al., 2014). The different codings were reviewed by the study team and included in the study according to their suitability. Care was taken to avoid any data loss during the interview process. The data obtained after the coding process were grouped into sub-themes and categories.

FINDINGS

In the research process, the opinions of science teachers regarding their competencies, awareness, relationship with the course, and misconceptions about the subject of seasons and climate were examined.

Question 1

In this question, it was aimed to question the scientific background of the teachers on the subject of seasons and climate. The data obtained in this context are categorized and presented in the table.

Table 3. Science Teachers' Ways of Acquiring Scientific Knowledge on Seasons and Climate

Opinions	**f**	**%**
No, I didn't.	15	68
I took an elective environment course.	4	18
I took an elective geography course.	3	14
Total	22	100

When Table 3 is analysed, 68% of the teachers stated that they did not take a course related to this subject content. On the other hand, 18% of them stated that they took an elective environmental course. At this point, teacher 8 stated, *I don't remember taking a course on the seasons and climate unit. We took an environment course. The subject of seasons and climates was mentioned in the environment course, but as I said, we did not take it as a separate course. The content of the subject was superficial and there was no in-depth explanation.* From this statement, it comes to the forefront that the information received within the scope of the environment course was limited. Those who dealt with it in detail were those who took elective geography courses. Teacher 4, who responded to this code, said *I took a geography course for one semester. There was a short presentation comparing the climate types in Turkey*, while teacher 1 said *We took it as an elective course, the content at the university was more detailed.* This situation shows that there is no consistency in conveying the scientific dimension of the content. In addition, the study revealed that it was determined that the teachers who took the elective geography course were mostly educated in well-established universities. At this point, increasing the variety of courses to be chosen offers individuals the opportunity to develop themselves in different fields.

Question 2

Within the scope of this question, data on the compatibility between the subject and the curriculum were trialled to be obtained. The data obtained were categorized and presented in Table 4.

Table 4. Science Teachers' Opinions on the Place of Seasons and Climate in the Curriculum

Opinions	**f**	**%**
Suitable	17	77
Not Applicable	5	23

77% of the science teachers in the study group stated that this topic is appropriate for the 8th grade science curriculum. When the opinions of the participants who used the expression "not suitable" were analysed, all of them stated that this topic should be taught in the social studies course. Teacher 19 stated that *This subject is not suitable for the principle of spirally in the curriculum. In the social studies curriculum, students currently see climate and climate change etc. in grades 5-6 and 7. When they reach 8th grade, we cover climate and weather events in science. I think it is appropriate to teach it in the social studies course.* When the opinions of the teachers who say it is appropriate are analysed, 40% of them state that it should be handled in a spiral structure in the context of space and the world subject area. Teacher 5 stated that "since space and celestial bodies are included in the subject of science, the movements of the planet earth and the results caused by these movements should be in the science program". Teachers 6, 7 and 8 stated that these subjects are related to the subjects in the lower grades in science. Teachers 12 and 14 emphasized that these topics have an interdisciplinary dimension. Teacher 22 also stated that it has an impact on science literacy.

Question 3

In the third question, it was trialled to obtain data on the learning of the subject by the students. The data obtained were categorized and presented in Table 5.

Table 5. Science Teachers' Opinions on the Adequate Learning of the Acquisitions in the Unit

Opinions	**N(f)**	**%**	**Sub Views**	**f**	**%**
Yes, they are learning.	13	59	Their readiness is adequate	3	23
			Relevance to daily life is effective	3	23
			Interest in the lesson	4	31
			National Exam will also be released	3	23
No they cannot learn.	9	41	Past learning is insufficient	2	28,6
			Abstract content	3	42,8
			Outcomes are not clear and unambiguous	2	28,6

When Table 5 is analysed, 59% of the teachers stated that students did not have difficulty in learning this subject. 41% of the teachers stated that students could not learn this subject or had difficulty in learning it. When the reasons for this situation are analysed, it is seen that 7 different opinions come to the fore. Of these, the most common view was that there was interest in the lesson. Teacher 5 stated that ...*I understand from the results of the exams and the dialogues in the classroom environment that every student who shows enough interest in the lessons has no difficulty in learning this unit.* In addition, readiness, being related to daily life and the fact that it will be on the central exam applied within the scope of the High School Transition System (National Exam) are the opinions stated to be effective in learning. The most frequently cited reason for not learning is that it contains abstract content. Teacher 2 stated that ... *the subject should be fully learned in the 5th and 6th grades. If it is not learned well in those years, the part in 8th grade remains abstract. Unfortunately, the student cannot learn at the expected level.* In addition, Teacher 22 stated that there is a problem in limiting the learning content by using the expression "*since the outcomes are not clear and precise, it causes different learning on the basis of class and teacher*".

Question 4

In the fourth question, it was trialled to obtain data on the extra practices of the teachers on the subject. The data obtained were categorized and presented in Table 6.

Table 6. Extra Practices Performed by Science Teachers

Opinions	**f**	**%**
Watch videos	5	20,8
I show animations	6	25
I conduct experiments and modelling studies	11	45,8
I commission projects	1	4,16
I'll make you do drama	1	4,16
Total	**24**	**100**

When Table 6 is examined, the majority of the opinions focused on experimentation and modelling. Teacher 2 stated *Especially in experiments, I try to make the angle of fall of light visual and concrete....* Experiments and modelling studies allow students to concretize. Other opinions focus on video and animation.

Question 5

In the fifth question, it was trialled to obtain data on the adequacy of the textbook on this subject. The data obtained were categorized and presented in Table 7.

Table 7. Teachers' Opinions on the Adequacy of Science Textbooks in the Scope of Subject Matter

Opinions	f	%
Sufficient for the curriculum	9	34,6
Related experiments should be increased	2	7,7
The subject is explained superficially	9	34,6
Measurement and evaluation practices are not sufficient	3	11,5
It will be enough if the activities are organized in the book	3	11,5
Total	**26**	**100**

When Table 7 is analysed, it is seen that teachers' opinions are grouped under 5 main headings. Among these, Teacher 14 stated *There is sufficient level of expression because the limitations are clear* and Teacher 19 stated *I think the textbooks are sufficient in terms of achievements*. At this point, it is stated that the curriculum has limitations. The most frequently expressed opinion is that the subject content is superficial. Teacher 17 said, *It should elaborate the information content a little more* and Teacher 3 said, *I do not find the textbook sufficient at all*. It is understood that it can be used when improvements are made in the content. Teacher 21 used the expression *experimental applications are insufficient*. Some of the opinions of the teachers (13.6%) were that measurement and evaluation practices were not sufficient. Teacher 16 stated that "the *number of questions in the book should be increased*".

Question 6

In the sixth question, it was trialled to obtain data on digital content on this subject. The data obtained are categorized and presented in Table 8.

Table 8. Teachers' Views on Digital Resources Other Than Textbooks

Opinions	f	%
I use the Education Information Network (EBA)	15	41,7
I use the resources of specialized publications	11	30,6
I use Youtube	4	11,1
I use self-prepared resources	5	13,9
I use Social Media	1	2,8
Total	**36**	**100**

When Table 8 is examined, it is determined that most of the opinions obtained from the teachers use EBA as a digital platform. Teacher 4 stated *I especially use EBA and YouTube*. As can be understood from this statement, teachers use multiple platforms together. This can be considered normal due to the structure of digital content. Teacher 9 used the statement *I use the course presentations I prepared myself and the EBA platform*. At this point, she states that the presentations and contents she prepared are effective. Teacher 21 said, *EBA and youtube videos are sufficient. However, misconceptions are very common in youtube videos.* From this point of view, she states that platforms that are not examined facilitate learning but also cause wrong teachers.

Question 7

The seventh question includes data on the misconceptions identified by the teachers about the subject. The data obtained are categorized and presented in Table 9.

Table 9. Teachers' Opinions on Misconceptions Related to the Subject

Opinions	**f**	**%**
No misconceptions occur	10	37
The concepts of rotation and entanglement are confused	3	11,1
The concept of enlightenment zone is confused	3	11,1
There is confusion with the angle of incidence of the rays	5	18,5
Misconceptions about precipitation types can occur	3	11,1
The concepts of weather events and climate are confused	3	11,1
Total	**27**	**100**

When the teachers' views on misconceptions are examined in Table 9, 10 teachers stated that no misconceptions occurred. Seven of the teachers who expressed these views are undergraduate graduates. Considering that they did not take these courses in undergraduate education, it can be said that they had difficulty in identifying misconceptions. Teacher 22 stated *They think that the sun's rays can fall everywhere at right angles*. Teacher 21 stated *They confuse weather events with climate. Since the unit is mostly at the comprehension and application level, students need to learn a lot of concepts, and there are problems in using high-level mental skills. For this reason, it would be appropriate to deal with the unit by breaking it down in lower grades.*" From this point of view, it is emphasized that the most important reason for misconceptions is insufficient lower learning.

Misconceptions and misconceptions are some of the biggest obstacles to correct learning. In addition to preventing correct learning, misconceptions and misconceptions are more difficult to correct than teaching the subject from scratch. One of the most important factors in preventing such mislearning is that the teacher's knowledge of the subject area should be very solid.

In the subject of seasons and climate, teachers' undergraduate education is very different (undergraduate graduation in different years) and teachers' desire and attempts to update their field competencies differ from each other. This situation causes misconceptions and confusion. In the study, it was seen that approximately 37% of the teachers stated that no misconceptions occurred, while the rest stated that misconceptions and confusion occurred in some subjects.

Question 8

In the eighth question, data were obtained on the appropriateness of the questions related to this subject in textbooks or auxiliary resources to the objectives and the appropriateness for the student. The data obtained were categorized and presented in Table 10.

Table 10. Teachers' Opinions on the Appropriateness of Questions in Textbooks or Auxiliary Resources

Opinions	**f**	**%**
The assessment questions in the textbook are very superficial.	6	16,7
The assessment questions in the supplementary resources contain very deep and complex information.	8	22,2
Not sufficient in terms of measurement in EBA	2	5,6
Publishers' questions are incorrect or not in line with the learning outcomes	11	30,6
Questions in the textbooks are appropriate to the level of the student	9	25,0
Total	**36**	**100**

When Table 10 is examined, the most frequently stated opinion is that the questions of the publishing house are incorrect and not suitable for the learning outcomes. Teacher 7 stated *There are questions outside the curriculum in supplementary resources*. Teacher 16 stated, *The questions in the textbook are appropriate for the learning outcomes.* When the situation is analysed in general, it is an important problem that the questions of the publishing houses are not suitable for the learning outcomes and contain meta-knowledge. On the other hand, the view that the questions in the textbook are in line with the learning outcomes comes to the fore, but a group expressed that they are superficial. This situation creates an inconsistency. Teacher 16 said, *The questions in the textbook are in line with the learning outcomes. However, in the question banks that our students use for National Exam preparation, there may be questions outside the objectives.* At this point, the existence of an exam such as National Exam creates this situation.

At the end of the interview, teachers were asked about their willingness to receive training on this subject. Fifteen of the teachers said yes and seven said no. It can be said that teachers are willing on this issue. Teacher 7 used the expression "*I would like to improve myself when the content and time are adjusted*". The fact that teachers are open to innovations is also an important factor at this point.

CONCLUSION AND DISCUSSION

Science teaching has been renewed by changing and developing according to the conditions of the time from the past to the present. In this process, previously prepared programs and books aim to eliminate systematic errors and achieve perfection by taking into account the feedback

received in the process. Many studies have been conducted on the examination of curricula and textbooks (Doğan et al., 2020; Karamustafaoğlu et al., 2016; Özcan et al., 2018; Yıldız Yılmaz & Tabacu, 2017). In these studies, there are contents for the development of curricula and textbooks. Within the scope of the study, it was tried to answer the research questions according to the data obtained in the context of examining the seasons and climate unit, which is among the contents of the 8th grade of the science curriculum, according to teacher opinions. At this point, the findings for each question were discussed and compared with the literature.

Since the seniority years of the teachers currently working in the Ministry of National Education generally vary between 1-45 years, the graduation status of the current teachers (teacher high school, associate degree, education institute, bachelor's degree), the curriculum, course contents, knowledge, skills and field infrastructure they have vary (Bilir, 2011). It was determined that 68% of the teachers participating in the study did not receive any undergraduate education on seasons and climate. It was seen that the fields were on environment and geography within the scope of elective courses. At this point, increasing the variety of elective courses can contribute to the development of individuals. It was concluded that teachers who could not improve themselves at this point in undergraduate education overcome their deficiencies by using personal development methods. When the studies on teachers' field and personal development are examined in the literature, it is seen that some teachers who have postgraduate education constantly improve themselves (in-service training, seminars, courses, etc.), while some teachers are closed to innovation and development (Altun & Sarpkaya, 2021; Eroğlu & Özbek, 2020; İnandı & Gılıç, 2020). In this context, before making changes in the curricula, it should be ensured that teachers' readiness regarding the subjects covering these changes is determined and that they receive training related to the subject area when necessary. In their study, Tekbıyık and Akdeniz (2008) found that no matter how willing teachers are to cope with changing curricula, they experience problems as a result of not knowing the curriculum. In addition, Kahramanoğlu (2019) found that teachers' curriculum literacy was at a medium level. In addition, there are studies on the inadequacy of curriculum introductions (Özcan et al., 2018; Ural Keleş, 2018). These results support the findings obtained from the study. Changes should be made after teachers are made ready for the curriculum changes. Otherwise, expecting teachers to adapt themselves to the changes made after the curriculum is changed leads to the formation of different levels among teachers regarding subject areas. As a result, providing the skills and infrastructure that need to be acquired as a result of the changes in the curriculum should not be left to the teachers' own initiative and a process-oriented solution should be followed.

Another topic addressed within the scope of the research is the efficiency and appropriateness of the books and existing content. At this point, as in the literature, the fact that the science course is more suitable for experiments, videos, animations, projects, etc. has been revealed in studies (Öztanrıkulu, 2020; Saklan & Ünal, 2019; Kapucu, 2014). It was determined that the majority of teachers generally focused on experiments and modeling studies in teaching the subject and increasing its retention, followed by animations and videos. In this context, the primary resources for teachers in teaching and retaining the subjects are the curriculum and textbooks. In the study, it is seen that the majority of teachers find the curriculum sufficient in

terms of subject matter, but they state that the subject matter is covered superficially in the textbooks. This situation is thought to be directly related to the National Exam. The fact that the subject is close to the Geography course in terms of content and that science teachers did not receive training on seasons and climate in their undergraduate education or received limited training reveals the view that teachers do not have in-depth knowledge in this field. When the studies in the literature are examined, there are findings that the subject is not given in depth on both activity and subject basis (Bayır & Kahveci, 2021; Erdoğan & Azizoğlu, 2022; Kahveci & Bayır, 2020; Şantaş, 2017). At this point, Erdoğan and Azizoğlu (2022) stated that life-based learning activities are very few in textbooks. Textbooks and their content should be strengthened digitally in line with the changing needs in line with the requirements of the age and offer alternative options by taking individual differences into consideration. When the results of the research are examined, it is seen that the majority of teachers prefer Education İnformation Network (EBA), which is enriched with digital content prepared by the MoNE and made available to teachers and students, as a digital resource other than textbooks. It was also found that a significant number of teachers preferred the resources prepared by private publications and the digital contents of these resources in addition to the textbook, some of them prepared the digital contents themselves, and some of them used social media environments. In the literature, it is seen that the most preferred digital resource of teachers is EBA (Aydınözü et al., 2016; Geçici, 2022; Yılmaz & Laçin Şimşek, 2017). It can be said that one of the most important reasons for this situation is controllability. At this point, it is seen that the use of digital content has become more widespread after the pandemic (Filiz & Gökmen, 2022; Yılmaz & Toker, 2022).

In the evaluation of the teaching of a subject, it is very important to identify misconceptions and to handle the process objectively in order to support the development of individuals. When the results are analyzed, it is seen that the teachers generally stated that the questions in the book were not directly related to the learning outcomes but remained superficial (at the recall-concept level). In his study, Genç (2020) stated that the assessment and evaluation practices in 8th grade textbooks did not include the competencies for PISA (Programme for International Student Assessment) at the desired level and that the content remained mostly at the level of comprehension. Yücel and Karamustafaoğlu (2020) stated in their study that the most frequently mentioned negative point about the textbooks was the assessment and evaluation activities. This situation is also seen in the study conducted by Köse (2021), and the study supports similar findings. In addition, the motivation of students due to the National Exam (High School Transition System) exam puts private publishing houses in a race and leads to out-ofachievement questions. This process in schools is not very healthy in terms of measurement. However, the sample questions published monthly by the Ministry of National Education serve as a guide for both students and teachers. In addition, in the interviews with the teachers participating in the study, they stated that there were misconceptions or confusion in the teaching of the subject (63%). At this point, it was seen that they learned the information especially at the level of recall and comprehension, but they had difficulty in the content related to high-level skills. At this point, the fact that teachers' field competencies are weak leads to the result that their motivation towards the lesson and the subject matter are not sufficiently understood by the students. This situation is similar to the result obtained by Sürücü and Ünal

(2018) in their study that motivation and interest in the course increases when the teacher does what he/she does in line with his/her interests and abilities and decreases in the opposite case. It is also consistent with the result of Ecevit and Şimşek (2017) that teachers have difficulty in identifying misconceptions. It has been determined in the studies in the literature that misconceptions are frequently seen in pre-service teachers who are trained in this field, especially in climate, wind, temperature and precipitation-based subjects (Pınar & Akdağ, 2012; Turan, 2006). This situation will be similar for teachers who do not take any course. As a result, as a result of the interviews with teachers, the study revealed that the content of textbooks should be improved. In addition, it is also important to increase teacher competencies.

In line with these results, the following recommendations are presented:

- Since the majority of teachers graduated from academic programs whose content has changed over the years, they have different competencies in some field subjects. In order to overcome this situation, in-service trainings should be given to teachers at certain time intervals.
- Reconsidering the limitations of the gains in a clearer and more understandable way and enriching the course materials with concrete content will contribute to the teaching of the subject.
- Teachers should focus on interactive activities such as experiments, modelling, animations and videos in order to increase comprehension.
- It is thought that it would be appropriate to enrich the textbooks in a way that does not require the use of special publications in terms of measurement and evaluation.
- It would be useful to enrich the lectures with interactive learning methods such as activities, experiments, etc. related to the subjects that students have difficulty in learning and where misconceptions occur more.

Since there is a central exam in National Exam at the grade level, students' use of special publications and auxiliary resources varies. However, since the same curriculum is applied throughout the country, it is thought that it would be appropriate for all supplementary resources to be examined in detail by the Ministry of National Education and to be allowed to be printed after a certain control process.

DECLARATIONS

Ethical Considerations: In this research, the ethics committee approval notification document containing the eligibility decision for the research was received from the Kastamonu University Social Sciences and Humanities Ethic Committee (Date: 09.03.2023, No: 2023/10). All ethical procedures were followed during and after completing the study.

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conducted the data collection process. She is competent in face-to-face interviews. Ç.A. and V.A. were responsible for statistical analysis. They are competent in the use of statistical programs. C.G. and V.A. were involved in the drafting of the article (introduction, discussion and conclusion). The editorial processes were followed by C.G. In addition, the referee feedbacks were handled jointly by the authors and necessary actions were taken.

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