

## Opinions of future biology teachers about their competencies in the field of education in the context of multilingual education

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### Abstract

This research aimed to determine the opinions of future biology teachers about the importance of language in biology teaching and effective techniques in biology teaching. With the start of education by students from different languages in public schools, the difficulties of the languages of education were experienced. For this reason, education becomes difficult. Students with different mother tongues make it difficult for teachers and may experience difficulties in fulfilling their duties. For this reason, this study was needed to determine the readiness of the pre-service teachers studying in the field of biology for the problems they may encounter in their professional lives. The opinions of 85 biology department senior students who are in their last year of university were consulted. For the questions to be used in the research, the research questions prepared by the researchers and finalised by taking the opinions of the experts were asked. The findings obtained in this study, which was carried out using the qualitative research design, were thematised and explained in detail with the content analysis method. When the results obtained from the research are examined, we see that the senior students of

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the biology teaching department do not have sufficient knowledge of multilingualism and that they need training on education-teaching strategies.

Keywords: Biology, education, university, multilingualism, opinion, teacher, technology, learning;

## 1. Introduction

It is very difficult to help students become scientifically literate in areas where scientific development is rapid, facts are complex and the amount of accumulated knowledge is very high (Duncan, Rogat, & Yarden, 2009). Although the idea of biological inheritance is as old as humanity, domestic animals and grains, the treatment of genetics as a discipline started in the 1900s. The pathways of classical genetics come from fields of study that have divergent purposes related to evolution, cytology, embryology and reproduction, reproduction and hybridisation, but have been considered an aspect of genetics since the 20th century (Carlson, 2004). There are many historical models in genetics that Carlson (1966) calls 'bogeyman models' because there is no simple and clear idea of the function of genes in the scientific community that existed simultaneously at a given time. Gericke and Hagberg (2007) suggested that there are five different historical models for the historical development of gene functions that differ in their epistemological features: (a) Mendelian's model, (b) classical model, (c) biochemical classical model, (d) neoclassical model and (e) modern model. These historical models are often superficial or imprecise and can be useful tools for both the scientific community and school science education to develop explanations or explanations of the world. Models can be used explicitly or implicitly in science education to relate to the curriculum, textbook or classroom environment in a retrospective context (Gericke, 2008).

To progress in learning, students should encounter explanations that give an idea of the nature of a particular phenomenon and that can be used for more phenomena. Teachers can use current social science topics to teach science content related to these topics and the nature of science (Lederman, Antink, & Bartos, 2014; Thörne & Gericke, 2014). The use of technology in education is very important. The methods and techniques learned in the teaching process determine whether they will be used in their professional lives in the future (Uzunboyulu et al., 2022). The task of teachers is to provide instruction. Studies show that neither teachers nor students typically have knowledgeable views on teaching (Driver, Leach, Millar, & Scott, 1996; Lederman & Lederman, 2004; Schwartz et al., 2002). However, the research basis is noticeably smaller than it is for NOS due to the lack of an easily available or frequently used instrument similar to the nature of science questionnaire (VNOS) (Lederman, Abd-El-Khalick, & Bell).

Tekkaya, Çapa, and Yılmaz (2000) determined in their study that pre-service biology teachers have learning difficulties about misconceptions in many subjects. The same researchers reported that students had many misconceptions about plant biology, ecology, digestive system, respiration, excretion, enzymes, diffusion and osmosis, cell division and classification. As a result of the research, it was stated that teacher candidates should be informed about the misconceptions identified task, content, forms, resources, methods and technologies of education of students belonging to this system and functions of future biology teachers in the upper level and structure of their vocational

education. According to research, genetics has long been recognised as one of the most important components of the basic biology curriculum, which is difficult to learn and teach (Gericke & Smith, 2014; Hickey, Kindfield, Horwitz, & Christie, 2003; Lewis & Wood-Robinson, 2000; Marbach-Ad & Stavy, 2000). Duncan et al. (2009) outline three main reasons why studying modern genetics is difficult. First, they note that it adds an interdisciplinary dimension to the field, as reasoning in modern genetics requires an understanding of chemical and physical interactions at the molecular level. Accordingly, they point out that this interdisciplinary dimension adds complexity to students who cannot understand the chemical structure of biological molecules and the basic knowledge of atoms and molecules. Second, citing earlier research, they argue that cellular and molecular processes and entities found in genetic phenomena are invisible and experimentally inaccessible to students (Marbach-Ad & Stavy, 2000).

Roseman, Stern, and Koppal (2010) tried to understand the molecular basis of inheritance. First of all, it is necessary to have a consistent understanding of the two main functions of DNA: 1) the function of DNA is to determine traits in organisms, and 2) the function of DNA. It is a function of the transfer of knowledge from one generation to the next. Accordingly, students are ready to transfer knowledge by knowing ideas about them and relating them to each other and using that knowledge biologically. They should be able to use it at different levels of the organisation. Studies have been conducted on the teaching of gene courses used in biology teaching. Duncan, Castro-Faix, and Choi (2014) reported that two frameworks developed as genetic learning progression (Duncan & Hmelo-Silver, 2009; Roseman, Calwell, Gogos, & Kurth, 2006). Based on their main approach, they first conducted a study on whether Mendelian Genetics or the Central Dogma of Molecular Biology should be taught.

Researchers have emphasised the importance of language in science education for over 40 years (Mortimer & Scott, 2003). Students especially experience problems with technical and non-technical vocabulary related to logical connections (Zhang & Lidbury, 2012). Here, language is not only a means of conveying different meanings but also a part of creating the meaning itself (Thörne, Gericke, & Hagberg, 2013). In order to learn scientific content, it is necessary to learn the original language of science first. In this direction, it is necessary to raise the awareness of teachers about the importance of language in science teaching. Frequent and daily misuse of terminology in science lessons, where conceptual differences are very high, causes students to have difficulties in the relationship between many concepts such as chromosome, gene, genetic information and alleles. Information about such concepts should be presented to students in a consistent manner and it is important to consider the epistemological features of the various disciplinary contexts in which the concept is used in genetics teaching (Flodin, 2009).

### *1.1. Research purpose*

This research aimed to determine the opinions of future biology teachers about the importance of language in biology teaching and effective techniques in biology teaching. In the problems experienced in education, it is necessary to eliminate the qualifications of teachers. The biology course is a branch where experiments are carried out frequently. With the start of education by students from different languages in public schools, the difficulties of the languages of education

were experienced. For this reason, education becomes difficult. Students with different mother tongues make it difficult for teachers and may experience difficulties in fulfilling their duties. For this reason, this study was needed to determine the readiness of the pre-service teachers studying in the field of biology for the problems they may encounter in their professional lives. With the result of this research, what kind of problems future biology teachers will experience in their professional lives can be determined in advance and necessary precautions can be taken accordingly.

### *1.2. Purpose of the study and research questions*

According to the purpose, the following research questions are asked:

1. How do you make biology concepts culturally friendly and understandable to linguistically diverse students?
2. What are some of the effective teaching strategies and techniques?
3. What are your views on the academic language you use in teaching and language learning for students?

## **2. Method**

With the start of education by students from different languages in public schools, the difficulties of the languages of education were experienced. For this reason, education becomes difficult. Students with different mother tongues make it difficult for teachers and may experience difficulties in fulfilling their duties. For this reason, qualitative interviews and document analysis techniques were used in the study conducted to determine the readiness of the pre-service biology teachers regarding the problems they may encounter in their professional lives. A descriptive research approach was carried out with the interview method, which is one of the qualitative research methods. Tekindal and Uguz (2020) stated that the focus of qualitative research is a research model that helps us understand participants' own perspectives and comments on a situation or topic (Mtemeri, 2022).

### *2.1. Data collection tools*

A demographic information form prepared by the researcher and a semi-structured interview form consisting of open questions were used to collect the research data. After the research questions were prepared, they were finalised by three experts in the field and three open-ended interview questions were applied to the students. The open-ended questions of the questionnaire were prepared based on the literature and the researchers' own experiences.

### *2.2. Research group*

This study, which was conducted with the students of the biology teaching department at the university, is a case study with a methodological basis. This study was conducted with students studying at a university with a biology teaching department in the spring semester of 2021–2022. 85 senior students studying in the biology department participated in the study on a voluntary basis. The questions were prepared in the form of semi-structured interview questions and the results

were analysed in detail with the content analysis method. As a result of the survey, the opinions of the students about their competence in teaching in the field of biology were taken.

Table 1. Demographic information

		<i>f</i>
Gender	Girls	53
	Boys	32
	Total	85
Age	18–20	24
	21–24	35
	24 and above	26
	Total	112

When the findings regarding the demographic information of the biology teaching department senior students at the university are examined, there are 53 female students and 32 male students. When the age range of the participants participating in the research is examined, there are 24 students in the 18–20 age range, 35 students in the 21–24 age range and 26 students in the age range of 24 and above.

### 3. Results

#### 3.1. Findings on teaching biology concepts to culturally friendly and linguistically diverse students

Table 2. Teaching biology concepts to culturally friendly and linguistically diverse students

Theme	<i>f</i>
The method should be chosen well	42
Similarity needs to be established	40
Must be empirical	22

When the findings of the biology department students studying at the university on the subject of linguistically teaching biology concepts are examined, the majority of the students stated that the method and technique should be chosen well. In the same way, the majority of students say that teaching by establishing a similarity makes teaching easier. There are 22 students who argue that experimental-based teaching should be weighted.

Opinions of some of the students are as follows:

‘Many of the students I observed while doing internships have misconceptions. It can be said that the reason for this is the language used and the textbooks. I can say that the methods chosen in the teaching of languages taught with difficulty are very important’.

‘Teaching becomes easier by establishing similarity. Especially when explaining the concepts used in the content of biology, which is a common field such as physics and chemistry in teaching concepts, it is very important that they are explained in the same way in other courses’.

### 3.2. Findings on effective teaching strategies and techniques

Table 3. Effective teaching strategies and techniques

	<i>f</i>
Experimental methods	42
Technology supported trainings	20
Cooperative learning	12
Cognitive learning	1

When we look at the findings of the last year students studying in the biology department regarding the methods and techniques used, there are 42 students who say experimental method, 20 students who say technology supported education, 12 students who say cooperative learning and 1 student who says cognitive learning.

Opinions of some of the students are as follows:

‘Teaching biology is a course in which experiments are predominant. The content in biology lessons is empirical. It includes information encountered in the everyday outside environment. For this reason, experiential-based teaching is very important’.

‘When we look at the teachings in our country, a teacher-centred approach is generally used in biology teaching. Teacher-centred teaching makes students passive and ensures that their learning is not permanent. For this reason, it is important to activate students mainly by using new techniques. Cooperative learning is one of these methods. With student-centred teaching, students can both learn easily with each other and use what they have learned in their daily lives. The method must be chosen very well’.

### 3.3. Findings regarding the academic language used in teaching and their views on language learning

Table 4. Academic language used in teaching and language learning

theme	<i>F</i>
It should be easy to understand	32
Difficult	30
Too many theoretical terms	23

There are 32 students who stated that their views on the academic language used in teaching the students who will be biology teachers of the future and on language learning should be made easier to understand. Likewise, the majority of students state that it is only difficult. It was found that there were pre-service teachers who stated that they contain too many theoretical terms.

Opinions of some of the students are as follows:

'Academic language is very important. While using these languages, there may be semantic confusion, that is, conceptual confusion. I can say that this situation is especially related to language problems in biology lessons. Learning becomes very difficult when the terms they learn outside and the terms in the academy are different'.

'I think it's awareness. With social responsibility projects, we can gain knowledge in many unknown areas'.

#### **4. Discussion and conclusion**

In order to prevent the problems experienced in the professions, the problems in the education they received at the university should be eliminated and they should be ready for the profession. The results obtained from this study, which aimed to determine the opinions of future biology teachers on the importance of language in biology teaching and effective techniques in biology teaching, can be said to be in the confusion of concepts and they do not feel ready for the profession.

When the results of the biology concepts of the students studying in the biology department at the university are examined, the majority of the students state that the method and technique should be chosen well. This result is very important. Methods and techniques are the most important element in providing teaching. Likewise, the majority of students say that teaching facilitates teaching by making similarity. It is seen that there are students who state that experimental-based teaching should be weighted. Concepts can become more understandable by experimental means. Ürek, Kayalı, and Tarhan (2002) stated that among students this one is personal and for learning can be transferred to teaching. Tekkaya et al. (2000) inaccurately established that candidates are tested in biology education and used in many subjects in the context of a biology course.

Method and technique is the most important element of education. When we look at the findings of the last year students studying in the biology department about the methods and techniques used, the results of experimental method, technology supported education, cooperative learning and cognitive learning have emerged. This situation shows that the pre-service teachers do not have sufficient knowledge about method and technique. In the relevant literature, the terms 'method' and 'technique' are strongly confused with each other. So, generally, this is defined as the shortest path to the destination. Technique the way the teaching method is applied in practice or can be defined as a set of transactions (Aydın, Sarıbaş, Özalp, & Yılmaz, 2021). Kamalov, Saipov, and Kamalov (2022), stated in their study that future teachers have deficiencies in methods and techniques and that the education they receive is insufficient. The importance of technology supported education is supported by other studies. There are studies in which the opinions of university students are positive about the technology-supported education they receive at the university (Urh, Jereb, Šprajc, Jerebic, & Rakovec, 2022).

When we look at the results of the findings of academic language and language learning used in the teaching of students who will be future biology teachers, which is another finding, it is concluded that they have a comprehension problem in the same way. Eliminating these problems in the education they receive at the university will prevent the problems that will be experienced in their future professional lives. It is supported by other studies that future biology educators have problems in methodical education (Arbuzova, 2011; Bulavintseva, 2011; Moroz, 2008; Stepaniuk, 2011; Traitak, 2002; Tsurul, 2011).

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