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Comparison of Chemistry and Physics Test Questions in the 2019-2023 Higher Education Institutions Entrance Exams in Terms of Content Validity

Şengül GACANOĞLU[1]

[1] Balıkesir University, Necatibey, Faculty of Education, Department of Chemistry Education, Balıkesir, Türkiye

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Corresponding author: Şengül GACANOĞLU
E-mail: sengul.gacanoglu@balikesir.edu.tr

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ABSTRACT

In the study, a total of 100 questions from the physics test in the Basic Proficiency Test (TYT) and Field Proficiency Tests (AYT) of the Higher Education Entrance Examinations (YKS) between 2019-2023 were analyzed within the framework of the 2018 Secondary Education Physics Curriculum (MoNE, 2018). The findings were carefully compared with the results of previous studies by Gacanoğlu (2024), Gacanoğlu and Nakiboğlu (2022), and Gacanoğlu and Nakiboğlu (2024) In the first part of analysis, it was found that, among the 213 learning achievements outlined in the 2018 physics curriculum, most questions were derived from the"Force and Motion" unit of the 9th-and 11th-grades. This indicated a lack of homogeneity in the distribution of questions across TYT and AYT physics tests. Nevertheless, it was ultimately concluded that the content validity of the YKS physics test questions was generally preserved, as questions addressed learning achievements from curriculum units. In the second part of the study, the content validity of the YKS physics and chemistry test questions was compared based on curriculum alignment. Although the chemistry test contained the highest number of achievement-based questions, its content validity was lower than that of the physics test due to the lack of questions on certain topics.

Keywords: 2018 physics curriculum, 2018 chemistry curriculum, basic proficiency test (TYT), field proficiency test (AYT)

Introduction

Academic achievement is one of the most important concepts in the education system in Türkiye (Yıldırım & Ergene, 2003). At the end of the 12 year education period, individuals take the YKS and take the first step towards career choices that will shape their lives. This challenging and demanding process is experienced by young people as one of increasing responsibility. In some cases, individuals may even feel that their equity is threatened during the examination and evaluation process (Yıldırım & Ergene, 2003). For this reason, the YKS must be carefully planned, implemented and evaluated.

In Türkiye, students take exams administered by Student Selection and Placement Center (ÖSYM) at the end of the 12th-grade. In this way, they attempt to qualify for university admission in their desired field of study. These exams, known as the Higher Education Institutions Exam (YKS), are held at the end of secondary education. The YKS exam is extremely important as it significantly affect an individual's professional and social future.

University admission in Türkiye was not based on exams in the 1960s. During those years, candidates were admitted based on application order, demand in relevant fields, and high school graduation scores. However, as the number of graduates and applicants increased, this system became insufficient. Consequently, universities began to conduct their own exams, which led to problems as students could not attend multiple exams held simultaneously. As candidate numbers continued to grow, an objective and comprehensive exam system became necessary. In 1974, the Interuniversity Board established Interuniversity Student Selection and Placement Center to centralize university entrance exams. This center oversaw exams until 1981, after which it was renamed ÖSYM (Measurement, Selection and Placement Center) in 2011 (ÖSYM, 2024a). Since the 1980s, exams have been administered in two stages: the first for selection and the second for placement. After 1987, both stages served placement purposes (Dökmen, 1992). From 1999 to 2010, the exam was held in a single stage under the name ÖSS (Student Selection System) (ÖSYM, 1999). Between 2010 and 2017, a two-stage system called Transition to Higher Education Exam (YGS) and Undergrade Placement Exam (LYS) was implemented. Since 2017, the system has continued as TYT and AYT (ÖSYM, 2024b).

The current YKS consists of two sessions: TYT and AYT. In TYT, students answer 120 questions across four fields (Turkish, Social Sciences, Science, and Mathematics) within 165 minutes. In AYT, 160 questions are answered in 180 minutes for verbal and numerical score types, while the foreign language test includes 80 questions in 120 minutes (MoNE, 2023). TYT assesses basic proficiency levels, while AYT calculates scores in four categories: Numerical, Equal Weight, Verbal, and Foreign Language (MoNE, 2023). Students answer questions according to the field they study (MoNE, 2023) and placement can be made in the preferred higher education institution according to the results of both exams. Exam result rankings of students are formed in the context of the latest updates made in YKS.

Following the 2017 update, both the names and content of the sessions were changed. According to Sarıca (2019), the most notable change was the significant reduction in the number of questions. Previously, YGS tests contained 14 physics, 13 chemistry, and 13 biology questions, and LYS tests had 30 from each field (ÖSYM, 2017). In the current system, TYT includes 7 physics, 7 chemistry, and 6 biology questions, while AYT includes 14 physics, 13 chemistry, and 13 biology questions (ÖSYM, 2023).

According to exam guides, this change led to a reduction of 20 questions (50%) in TYT and 50 questions (over 50%) in AYT. This shift has sparked discussions on exam content validity and its implications for student preparation (ÖSYM, 2017; ÖSYM, 2023). The change in the number of questions has raised several issues, such as where the exam questions will be drawn from, which subjects should be prioritized during preparation, whether the difficulty level of the exam will change with fewer questions, and how the content validity of the exam will be affected. Consequently, this situation has led to increased discussion of the content validity of YKS in the academic literatüre.

Studies addressing content validity can be found across all subject areas covered in the YKS. For instance, Çoban and Hançer (2006), in their study examining how the weight of secondary school physics subjects varies by grade level and how this distribution is reflected in ÖSS physics test questions, reported issues with content validity in both the curriculum and the ÖSS questions. Similarly, Biçer (2013), in his study on the content validity of 122 psychology, sociology, and logic questions from the philosophy section of the LYS exam (prior to 2018), concluded that the questions were not homogeneously distributed across units and learning activities.

Ayvacı et al. (2018) analyzed physics questions from the university entrance exam in terms of the learning achievements in both the secondary school physics and primary school science and technology curricula, and found that questions were based on achievements from both curricula. Efe and Temelli (2003) evaluated the 1999–2001 ÖSS biology questions in terms of content and difficulty levels to determine what knowledge and skills were required to answer them and whether they aligned with the secondary and high school biology curricula. They concluded that although the questions generally matched the textbooks and curricula, in some years students had difficulty answering due to factors such as questions exceeding their level or inadequate time being allocated to certain topics.

Dursun and Parim (2014) found that the mathematics questions in the YGS exam (as it was known in 2013) primarily targeted the application level of Bloom's Taxonomy. Gürbüz and Biber (2021) analyzed 363 mathematics questions asked between 1966 and 2019, focusing on the topics of limits, derivatives, and integrals. They found that derivative questions were the most frequently asked, while limit questions were the least common, with a steady increase in questions on integrals.

Gacanoğlu and Nakiboğlu (2022) reported problems with the content validity of the TYT and AYT chemistry test questions administered after 2018, based on the learning achievements defined in the chemistry curriculum. Manyas (2022), in her thesis analyzing biology test questions from 2012 to 2022 using the revised Bloom's Taxonomy, concluded that the questions were not evenly distributed across the cognitive domains. In another study, Gacanoğlu (2024) examined the content validity of YKS chemistry and biology questions between 2019 and 2023, and found that although the biology questions showed content validity, they lacked homogeneous distribution, while the chemistry questions had more significant content validity issues.

Purpose of the Study

In this study, the Physics test questions in the TYT and AYT exams between the 2019 and 2023 academic years were analyzed based on the learning achievements of the 2018 Secondary School Physics Curriculum (MoNE, 2018), and the content validity was evaluated in terms of subject coverage. Additionally, these findings were compared with those related to the content validity of the Chemistry test questions in the YKS, as reported in the studies by Gacanoğlu (2024), Gacanoğlu and Nakiboğlu (2022), and Gacanoğlu and Nakiboğlu (2024). It is believed that this study may contribute to ensuring a more balanced distribution of the 2024 YKS exam questions in alignment with curriculum achievements and support the review of content validity. To this end, the study seeks to answer the following research questions:

- Which of the physics test questions in the YKS exams administered between 2019 and 2023 align with the 9th-grade achievements of the 2018 Physics Curriculum, and how are these questions distributed across units?

- Which of the physics test questions in the YKS exams administered between 2019 and 2023 align with the 10th-grade achievements of the 2018 Physics Curriculum, and what is the unit-based distribution of these questions?

- Which of the physics test questions in the YKS exams administered between 2019 and 2023 align with the 11th-grade achievements of the 2018 Physics Curriculum, and how are these questions distributed across units?

- Which of the physics test questions in the YKS exams administered between 2019 and 2023 align with the 12th-grade achievements of the 2018 Physics Curriculum, and what is the unit-based distribution of these questions?

- What is the overall distribution of the physics test questions in the YKS exams administered between 2019 and 2023 by grade level and unit, according to the 2018 Physics Curriculum?

- Are there any similarities or differences between the number of physics and chemistry test questions in the YKS exams between 2019 and 2023 in terms of grade level and unit coverage based on the relevant curricula?

Method

Research Model

In this study, document analysis, one of the qualitative research methods, was employed. This method is used to make meaningful evaluations about a subject (Nakiboğlu, 2021). Document analysis is a functional data collection technique, and since there are no participants involved, there are no reactive situations arising from participant behavior. It is also considered effective for long-term research (Özkan, 2019). In the document review method, existing resources and documents are examined, making it a purposeful evaluation process (Karasar, 2005). According to Bowen (2009), document analysis involves the examination and evaluation of various printed and non-printed sources.

Data Sources of the Research

In this study, the 2018 Secondary School Physics Curriculum (MoNE, 2018) was used as the primary data source. The physics questions from the science sections of the TYT and AYT sessions of the YKS exams administered between 2019 and 2023 were used as the secondary data sources (ÖSYM, 2019; ÖSYM, 2020; ÖSYM, 2021; ÖSYM, 2022; ÖSYM, 2023). Ethical approval has not been obtained for the data sources of this research, namely the YKS physics and chemistry test questions. The YKS questions have been publicly shared by ÖSYM on its official website, and the questions themselves have not been directly used. The study presents the results of an analysis regarding the content validity of the questions.

Data Analysis

Within the scope of the study, a total of 105 physics questions were analyzed 35 from the TYT and 70 from AYT. The questions were retrieved from the official website of ÖSYM (ÖSYM, 2019; ÖSYM, 2020; ÖSYM, 2021; ÖSYM, 2022; ÖSYM, 2023). The findings of chemistry test questions from the studies by Gacanoğlu (2024), Gacanoğlu and Nakiboğlu (2022), and Gacanoğlu and Nakiboğlu (2024) were used as references in the comparison tables.

Each physics question in the YKS exams was compared with the learning achievements of the 2018 Physics Curriculum. If a question was determined to be related to a specific achievement, it was coded with the achievement number, the name of the YKS session, the year of the exam, and the order of the question in the test (e.g., “TYT-2020-1…”). Tables were created to display the codes of the related achievements and the number of questions associated with each grade level and unit.

Results

The findings are presented and explained under separate headings to answer the research questions.

Findings Concerning the First Research Question

The findings of the 2019 TYT and AYT exam questions, obtained through document analysis in relation to the achievements outlined in the 2018 Physics Curriculum, to which the 2019 YKS physics test questions correspond, are presented in Table 1.

Table 1.
Distribution of 2019 TYT and AYT Physics Test Questions by Unit, Achievement Number and Grade Level

Question Identity	Number of Achievement	Unit Name	Grade Level
TYT-2019-1	9.2.1.1.	Substance and Properties	9
TYT-2019-2	9.3.1.2.	Motion and Force	9
TYT-2019-3	9.4.1.1.	Energy	9
TYT-2019-4	9.5.5.1.	Heat and temperature	9
TYT-2019-5	10.1.2.3.	Electricity and Magnetism	10
TYT-2019-6	10.4.1.2.	Optical	10
TYT-2019-7	10.4.9.1.	Optical	10
AYT-2019-1	11.1.2.1.	Force and Motion	11
AYT-2019-2	11.1.5.2	Force and Motion	11
AYT-2019-3	11.1.7.1.	Force and Motion	11
AYT-2019-4	11.1.3.1.	Force and Motion	11
	11.1.8.2.	Force and Motion	11
	11.1.7.1.	Force and Motion	11
AYT-2019-5	11.2.1.1.	Electricity and Magnetism	11
	11.2.2.1.	Electricity and Magnetism	11
AYT-2019-6	10.1.3.1.	Electricity and Magnetism	10
	10.1.4.1.	Electricity and Magnetism	10
AYT-2019-7	11.2.5.3.	Electricity and Magnetism	11
AYT-2019-8	12.1.1.4.	Circular Motion	12
AYT-2019-9	12.1.3.3.	Circular Motion	12
AYT-2019-10	12.2.1.4.	Simple Harmonic Motion	12
AYT-2019-11	12.3.2.1.	Wave Mechanics	12
AYT-2019-12	12.4.3.2.	Introduction to Atomic Physics and Radioactivity	12
AYT-2019-13	12.5.3.4.	Modern Physics	12
AYT-2019-14	12.6.1.1.	Applications of Modern Physics in Technology	12

Looking at Table 1, it is evident that the 2019 TYT physics questions were prepared based on a total of seven different achievements. In terms of grade-level distribution, four questions were aligned with 9th-grade objectives, three with 10th-grade objectives, and no questions were prepared based on the 11th- and 12th-grade achievements. Table 1 also indicates that, the 2019 AYT physics questions were prepared based on two objectives at the 10th-grade level, eight at the 11th-grade level, and seven at the 12th-grade level. The unit with the highest number of questions was the 11th-grade "Force and Motion" unit. No questions were based on the 9th-grade objectives. In total, the 2019 AYT physics questions were prepared from 18 different achievements.

Findings Concerning the Second Research Question

Based on the analysis of the 2018 Physics Curriculum related to the 2020 TYT and AYT exam questions, the findings for the 2020 TYT and AYT exam questions are shown in Table 2.

Table 2.
Distribution of 2020 TYT and AYT Physics Test Questions by Unit, Achievement Number, and Grade Level

Question Identity	Number of Achievement	Unit Name	Grade Level
TYT-2020-1	9.1.3.1.	Introduction to Physical Science	9
TYT-2020-2	9.3.3.2.	Motion and Force	9
	9.3.3.3.	Motion and Force	9
	11.1.7.2.	Force and Motion	11
TYT-2020-3	10.2.2.1.	Pressure and Buoyancy	10
TYT-2020-4	9.5.1.5.	Heat and temperature	9
TYT-2020-5	10.1.2.1.	Electricity and Magnetism	10
	10.1.2.3.	Electricity and Magnetism	10
TYT-2020-6	10.3.2.2.	Waves	10
TYT-2020-7	10.4.4.1.	Optical	10
AYT-2020-1	11.1.2.2.	Force and Motion	11
AYT-2020-2	11.1.3.1.*	Force and Motion	11
AYT-2020-3	11.1.4.6.	Force and Motion	11
AYT-2020-4	11.1.6.2.	Force and Motion	11
AYT-2020-5	11.1.7.4.	Force and Motion	11
AYT-2020-6	11.1.3.1. *	Force and Motion	11
AYT-2020-7	11.2.1.3.	Electricity and Magnetism	11
AYT-2020-8	11.2.4.7.	Electricity and Magnetism	11
AYT-2020-9	11.2.6.2.	Electricity and Magnetism	11
AYT-2020-10	12.1.1.3.	Circular Motion	12
AYT-2020-11	11.1.7.2.	Force and Motion	11
AYT-2020-12	12.1.3.3.	Circular Motion	12
AYT-2020-13	12.3.1.2.	Wave Mechanics	12
AYT-2020-14	12.2.1.4.	Simple Harmonic Motion	12

** Recurring achievements.*

Looking at Table 2, it is evident that the 2020 TYT physics questions were prepared from a total of ten different achievements. Regarding their distribution by grade level, four objectives were from the 9th grade, five from the 10th grade, and one from the 11th-grade. No questions were based on 12th-grade achievements. Table 2 also indicates that the 2020 AYT physics questions were prepared from a total of 13 different achievements. These achievements were distributed across the grade levels as follows: nine achievements from the 11th-grade (one of which was not counted twice because it was a recurring achievement),

and four achievements from the 12th grade. No questions were prepared from the achievements of the 9th and 10th grades. It was determined that the unit with the most questions was the 11th-grade "Force and Motion" unit.

Findings Concerning the Third Research Question

Based on the analysis conducted regarding the achievements of the 2018 Physics Curriculum, which the physics questions of the 2021 TYT and AYT exams are aligned with, the findings of the 2021 TYT and AYT exam questions are presented in Table 3.

Table 3.

Distribution of 2021 TYT and AYT Physics Test Questions by Unit, Achievement Number, and Grade Level

Question Identity	Number of Achievement	Unit Name	Grade Level
TYT-2021-1	9.2.3.1.	Substance and Properties	9
TYT-2021-2	9.3.3.1.	Motion and Force	9
TYT-2021-3	10.2.1.1.	Pressure and Buoyancy	10
TYT-2021-4	9.5.4.2.	Heat and temperature	9
TYT-2021-5	10.1.2.3.	Electricity and Magnetism	10
TYT-2021-6	10.3.1.1.	Waves	10
TYT-2021-7	10.4.7.2.	Optical	10
AYT-2021-1	11.2.1.3.	Electricity and Magnetism	11
AYT-2021-2	9.3.1.4.	Force and Motion	11
	11.1.5.1.	Force and Motion	11
AYT-2021-3	11.1.5.2.	Force and Motion	11
AYT-2021-4	11.1.8.2.	Force and Motion	11
	11.1.9.1.	Force and Motion	11
AYT-2021-5	11.2.2.1.	Electricity and Magnetism	11
AYT-2021-6	11.2.4.1.	Electricity and Magnetism	11
AYT-2021-7	11.2.6.1.	Electricity and Magnetism	11
	11.2.6.2.	Electricity and Magnetism	11
AYT-2021-8	12.1.1.2.	Circular Motion	12
AYT-2021-9	12.1.1.3.	Circular Motion	12
	12.1.5.1.	Circular Motion	12
AYT-2021-10	12.2.1.1.	Simple Harmonic Motion	12
AYT-2021-11	12.3.1.3.	Wave Mechanics	12
AYT-2021-12	12.4.3.1.	Introduction to Atomic Physics and Radiation	12
AYT-2021-13	12.5.3.2.	Modern Physics	12
	9.6.1.1.	Electrostatic	9
AYT-2021-14	12.6.5.1.	Applications of Modern Physics in Technology	12

Looking at Table 3, it is evident that the 2021 TYT physics questions were prepared based on a total of seven different achievements. Considering the distribution of these achievements by grade level, three were from the 9th grade, four from the 10th grade, and none from the 11th or 12th-grade levels. Table 3 also indicates that the 2021 AYT physics questions were prepared based on a total of 19 different achievements. In terms of grade-level distribution, one achievement was from the 9th grade, ten from the 11th-grade, and eight from the 12th grade, while no questions were prepared from the 10th-grade level. The unit with the most questions was the "Force and Motion" unit at the 11th-grade level.

Findings Concerning the Fourth Research Question

Based on the analysis conducted regarding the achievements of the 2018 Physics Curriculum, which the physics questions of the 2022 TYT and AYT exams correspond to, the findings of the 2022 TYT and AYT exam questions are presented in Table 4.

Table 4.

Distribution of 2022 TYT and AYT Physics Test Questions by Unit, Achievement Number, and Grade Level

Question Identity	Number of Achievement	Unit Name	Grade Level
TYT-2022-1	9.2.1.1.	Substance and Properties	9
TYT-2022-2	9.3.3.3.	Motion and Force	9
TYT-2022-3	10.2.1.2.	Pressure and Buoyancy	10
TYT-2022-4	9.5.4.2.	Heat and temperature	9
TYT-2022-5	9.3.3.1.	Motion and Force	9
	9.6.1.3.	Electrostatic	9
TYT-2022-6	10.3.3.3.	waves	10
TYT-2022-7	10.4.4.1.	Optical	10
AYT-2022-1	11.1.3.1.	Force and Motion	11
AYT-2022-2	11.1.2.2.	Force and Motion	11
	11.1.3.2	Force and Motion	11
AYT-2022-3	11.1.7.2.	Force and Motion	11
AYT-2022-4	11.1.8.2.	Force and Motion	11
AYT-2022-5	11.2.4.10.	Electricity and Magnetism	11
AYT-2022-6	12.5.4.1.	Modern Physics	12
AYT-2022-7	11.2.6.1.	Electricity and Magnetism	11
AYT-2022-8	12.1.1.1.	Circular Motion	12
AYT-2022-9	12.1.5.1.	Circular Motion	12
AYT-2022-10	12.2.1.1.	Simple Harmonic Motion	12
AYT-2022-11	12.3.1.6.	Wave Mechanics	12
AYT-2022-12	12.4.2.2.	Introduction to Atomic Physics and Radioactivity	12
AYT-2022-13	12.5.1.2.	Modern Physics	12
AYT-2022-14	12.6.1.1.	Applications of Modern Physics in Technology	12

Looking at Table 4, it is evident that the 2022 TYT physics questions were prepared based on a total of eight different achievements. In terms of grade-level distribution, five achievements were from the 9th grade and three from the 10th grade, while no questions were based on the 11th- or 12th-grade achievements. Table 4 also indicates that the 2022 AYT physics questions were prepared from a total of 14 different achievements. Considering the distribution of these achievements by grade level, seven belong to the 11th grade and eight to the 12th-grade, while none are from the 9th- or 10th-grades. The unit with the most questions is "Force and Motion" at the 11th-grade level.

Findings Concerning the Fifth Research Question

From the analysis conducted regarding the achievements of the 2018 Physics Curriculum, to which the physics questions of the 2023 TYT and AYT exams are related, the findings of the 2023 TYT and AYT exam questions are presented in Table 5.

Table 5.

Distribution of 2023 TYT and AYT Physics Test Questions by Unit, Achievement Number, and Grade Level

Question Identity	Number of Achievement	Unit Name	Grade Level
TYT-2023-1	10.2.1.2.	Pressure and Buoyancy	10
TYT-2023-2	9.3.1.2.	Motion and Force	9
TYT-2023-3	10.1.2.3.	Electricity and Magnetism	10
TYT-2023-4	9.5.4.1.	Heat and temperature	9
TYT-2023-5	10.1.2.3.	Electricity and Magnetism	10
TYT-2023-6	10.4.1.2.	Optical	10
TYT-2023-7	10.4.3.1.	Optical	10
AYT-2023-1	11.1.1.3.	Force and Motion	11
AYT-2023-2	11.1.3.2.	Force and Motion	11
AYT-2023-3	11.1.4.1.	Force and Motion	11
AYT-2023-4	11.1.7.4.	Force and Motion	11
AYT-2023-5	11.1.8.2.	Force and Motion	11
AYT-2023-6	11.2.4.1.	Electricity and Magnetism	11
AYT-2023-7	11.2.3.5.	Electricity and Magnetism	11
AYT-2023-8	11.2.6.1.	Electricity and Magnetism	11
AYT-2023-9	11.2.5.4.	Electricity and Magnetism	11
AYT-2023-10	12.2.1.3.	Simple Harmonic Motion	12
AYT-2023-11	12.1.3.3.	Circular Motion	12
AYT-2023-12	12.1.1.1.	Circular Motion	12
	12.1.5.1.	Circular Motion	12
AYT-2023-13	12.2.1.5.	Simple Harmonic Motion	12
AYT-2023-14	12.3.1.2.	Wave Mechanics	12

Looking at Table 5, it is evident that the 2023 TYT physics questions were prepared from a total of seven different achievements. In terms of grade-level distribution, two achievements belong to the 9th grade and five to the 10th-grade, while no questions were prepared from the 11th- and 12th-grade levels. Table 5 also indicates that the 2023 AYT physics questions were prepared from a total of 15 different achievements. According to grade level, nine achievements belong to the 11th- grade and six to the 12th grade, while no questions were prepared from the 9th- and 10th-grade levels. The unit for which the most questions were prepared was the "Force and Motion" unit at the 11th-grade level.

Findings Concerning Sixth Research Question

A comparison of the chemistry and physics questions asked in the TYT and AYT sessions of the YKS exams administered between 2019 and 2023, in terms of unit, grade level, and number of achievements, is shown in Table 6 and Table 7.

Table 6.

Comparison of TYT Chemistry Test Questions and Physics Test Questions (2019–2023) in Terms of Number of Achievements / Grade Level

Grade Level	2019 TYT (Gacanoğlu & Nakiboğlu, 2022)		2019 TYT Physics		2020 TYT Chemistry (Gacanoğlu & Nakiboğlu, 2022)		2020 TYT Physics		2021 TYT Chemistry (Gacanoğlu & Nakiboğlu, 2022)		2021 TYT Physics		2022 TYT Chemistry (Gacanoğlu, 2024)		2022 TYT Physics		2023 TYT Chemistry (Gacanoğlu & Nakiboğlu, 2024)		2023 TYT Physics	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
9	7	5.51	4	1.88	8	6.29	4	1.88	5	3.94	9	4.23	6	6.59	5	2.35	4	3.15	2	0.94
10	3	2.36	3	1.41	6	4.72	5	2.35	4	3.15	4	1.88	4	3.15	3	1.41	4	3.15	5	2.35
11	3	2.36	0	0	3	2.36	1	0.47	2	1.57	0	0	1	0.79	0	0	0	0	0	0
12	2	1.57	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	15	11.81	7	3.29	17	13.38	10	4.69	11	8.66	13	6.10	11	8.66	8	3.76	8	6.30	7	3.29

Table 7.

Comparison of AYT Chemistry Test Questions and Physics Test Questions (2019–2023) in Terms of Number of Achievements / Grade Level

Grade Level	2019 AYT Chemistry (Gacanoğlu & Nakiboğlu, 2022).		2019 AYT Physics		2020 AYT Chemistry (Gacanoğlu & Nakiboğlu, 2022).		2020 AYT Physics		2021 AYT Chemistry (Gacanoğlu & Nakiboğlu, 2022).		2021 AYT Physics		2022 AYT Chemistry (Gacanoğlu, 2024).		2022 AYT Physics		2023 AYT Chemistry (Gacanoğlu & Nakiboğlu, 2024).		2023 AYT Physics	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
9	0	0	0	0	0	0	0	0	0	0	1	0.47	0	0	0	0	0	0	0	0
10	4	3.17	2	0	5	3.94	0	0	5	3.94	0	0	0	0	0	0	4	3.15	0	0
11	14	11.02	8	0.94	13	10.24	9	4.23	19	14.96	10	4.69	11	8.66	7	3.29	9	7.09	9	4.23
12	10	7.84	7	3.29	5	3.94	4	1.88	7	5.51	8	3.75	7	5.51	8	3.75	3	2.36	6	2.82
TOTAL	28	22.05	17	7.98	23	18.11	13	6.10	22	17.32	19	8.92	18	14.17	13	6.10	16	12.59	15	7.04

When Table 6 is examined, it is seen that:

- In 2019, TYT physics test questions covered 3.29% of curriculum achievements, while chemistry covered 11.81%. Thus, chemistry had higher content validity.
- In 2020, TYT physics covered 4.69%, chemistry 13.38% — again, chemistry showed higher content validity.
- In 2021, physics covered 6.10% and chemistry 8.66% — chemistry still had higher validity.
- In 2022, physics covered 3.76%, chemistry 8.66% — chemistry remained higher.
- In 2023, physics covered 3.29%, chemistry 6.30% — chemistry test questions again showed higher content validity.

It can therefore be concluded that, across all years, the TYT chemistry test consistently demonstrated higher content validity and included a broader range of achievements than the physics test.

When Table 7 is examined:

- In 2019, AYT physics covered 7.98% of the curriculum achievements, whereas chemistry covered 22.05%.
- In 2020, physics covered 6.10%, chemistry 18.11%.
- In 2021, physics covered 8.92%, chemistry 17.32%.
- In 2022, physics covered 6.10%, chemistry 14.17%.
- In 2023, physics covered 7.04%, chemistry 12.59%.

In all cases, the chemistry test questions had higher content validity than the physics questions, suggesting that more curriculum achievements were addressed in the chemistry section each year.

Discussion

This study aimed to summarize the content validity of the physics questions in TYT and AYT of the YKS administered between 2019 and 2023. It focused on the alignment of these questions with the achievements defined in the Secondary Education Physics Curriculum and included a comparison with chemistry questions from the same period.

The findings revealed that the TYT and AYT physics test questions from the YKS exams administered between 2019 and 2023 were fully aligned with the achievements of the Secondary Education Physics Curriculum. It was determined that the questions in the TYT physics test primarily targeted the 9th and 10th-grade achievements, while the AYT physics test questions focused on the 11th and 12th-grade levels. It was also found that there were no units left unrepresented by questions, although a significant concentration of questions stemmed from the "Force and Motion" unit at both the 9th and 11th-grade levels. This indicates a lack of homogeneous distribution across the curriculum, consistent with the findings of Çoban and Hançer (2006) and Çoban et al. (2006), who reported similar results in the 2006 ÖSS exam.

Due to the COVID-19 pandemic and the 2023 earthquake disaster, the scope of the curriculum was narrowed in 2020 (MoNE, 2020), and no questions were asked from the excluded topics. Apart from these exceptional circumstances, no significant issues were found regarding the content validity of the physics test questions.

When the TYT and AYT chemistry test questions from 2019 and 2022 were examined, it was found that the "Nature and Chemistry" and "Energy Resources and Scientific Developments" units were not represented. This aligns with the findings of Gacanoğlu and Nakiboğlu (2022) and Gacanoğlu (2024), who identified content validity problems in the TYT-AYT chemistry tests. Overall, it was determined that the YKS physics and chemistry test questions administered between 2019 and 2023 lacked homogeneity and had content validity issues.

Conclusion and Recommendations

A different perspective on the TYT and AYT chemistry and physics tests shows that the total number of achievements in the Secondary Education Physics Curriculum is 213, while the Chemistry Curriculum has 127 achievements. The number of objectives for which questions were prepared was significantly lower than the total number of achievements in both subjects. This indicates that a substantial portion of the physics curriculum was not reflected in the exams, resulting in a lack of homogeneity.

Based on the findings of this study, the following recommendations are made to improve the content validity of the 2019–2023 YKS physics test questions and their comparison with chemistry test questions:

• Ensuring a homogeneous distribution of YKS physics test questions across all achievements could increase students' motivation and reduce anxiety during exam preparation.
• Improving the content validity of YKS chemistry test questions could prevent negative experiences for students and their families and support a more effective preparation process.
• Reviewing the units selected for question preparation in both physics and chemistry and increasing the number of represented achievements could enhance student engagement and lead to more effective learning.

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