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Do the Large-Scale Exams in Brazil and Portugal Require the Competences, Recommended by the Curricula?

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Abstract

The curriculum of Portugal and Brazil determine which competences should be developed in students throughout high school. Large-scale exams in Portugal and Brazil have been applied for at least two decades. The objective of this study was to analyse the correspondence between what the official documents determine, from a perspective of competences to be developed in the students, by the biology discipline, in Portugal, and Brazil about what is requested in their National Exams. For this, an empirical study of a documentary nature was developed, which focused on the analysis of the ENEM in Brazil and the National Exams in Portugal. The body of analysis consisted of questions formulated for exams carried out between 2010 and 2016. The analysis carried out by this research evidenced the difficulty in using multiple-choice questions to test the various academic aptitudes, with a predominance of cognitive ones with 86% and 85% in phases 1 and 2, respectively of the National Exam in Portugal and 96% in the ENEM. Large-scale exams in Portugal and Brazil do not seem very suitable for promoting the training described in the official documents of both countries. Making it clear that it is not enough to develop competences in students through learning strategies and curriculum adequacy if the internal and external assessment instruments are unable to ascertain whether these competences are being developed in students.

Keywords: national exam, competences, large scale assessment, biological literacy, educational formation, ENEM

Será que os Exames em Larga Escala no Brasil e em Portugal Requerem as Competências, Preconizadas Pelos Currículos?

Resumo

O curriculum de Portugal e Brasil determinam quais competências devem ser desenvolvidas nos alunos ao longo do ensino médio. Exames de larga escala em Portugal e no Brasil são aplicados há, pelo menos, duas décadas. Analisar a correspondência entre o que determinam os documentos oficiais, numa perspectiva de competências a serem desenvolvidas nos alunos, pela disciplina Biologia, em Portugal e no Brasil em relação ao que é solicitado em seus Exames Nacionais foi o objetivo deste estudo. Para isso, foi desenvolvido um estudo empírico de caráter documental, que se concentrou na análise do ENEM no Brasil e dos Exames Nacionais em Portugal. O corpo de análise foi constituído de perguntas formuladas para os exames realizados entre 2010 e 2016. A análise feita por esta pesquisa evidenciou a dificuldade no uso de questões de múltipla escolha para testar as diversas aptidões acadêmicas, havendo o predomínio das cognitivas com 86% e 85% nas fases 1 e 2, respectivamente, do Exame Nacional em Portugal e 96% nas provas do ENEM. Os exames em larga escala em Portugal e no Brasil não parecem muito adequados para promover a formação descrita nos documentos oficiais de ambos os países. Deixando evidente que não basta desenvolver competências nos estudantes através de estratégias de aprendizagem e adequação do currículo se os instrumentos de avaliação interna e externa não conseguem averiguar se estas competências estão sendo realmente desenvolvidas nos alunos.

Palavras-chave: exame nacional, competências, avaliação em larga escala, literacia biológica, formação educacional, ENEM

¿Las Evaluación a Gran Escala en Brasil y Portugal Exigen las Competencias Recomendadas por los Currículos?

Resumen

Los currículos de Portugal y Brasil determinan qué competencias se deben desarrollar en los estudiantes a lo largo de la escuela secundaria. Los exámenes a gran escala en Portugal y Brasil se han aplicado durante al menos dos décadas. El objetivo de este estudio fue analizar la correspondencia entre lo que determinan los documentos oficiales, desde una perspectiva de competencias a ser desarrolladas en los estudiantes, por la disciplina de Biología, en Portugal y en Brasil en relación a lo solicitado en sus Exámenes Nacionales. Para ello, se desarrolló un estudio empírico de carácter documental, que se centró en el análisis de la ENEM en Brasil y de los Exámenes Nacionales en Portugal. El cuerpo de análisis estuvo constituido por preguntas formuladas para exámenes realizados entre 2010 y 2016. El análisis realizado por esta investigación evidenció la dificultad de utilizar preguntas de opción múltiple para evaluar las diversas aptitudes académicas, con predominio de las cognitivas con un 86% y 85% en las fases 1 y 2, respectivamente, del Examen Nacional de Portugal y 96% en las pruebas ENEM. Los exámenes masivos en Portugal y Brasil no parecen muy adecuados para promover la formación descrita en los documentos oficiales de ambos países. Dejando en claro que no basta con desarrollar competencias en los estudiantes a través de estrategias de aprendizaje y adecuación curricular si los instrumentos de evaluación internos y externos no logran determinar si estas competencias se están desarrollando efectivamente en los estudiantes.

Palabras clave: examen nacional, habilidades, evaluación a gran escala, alfabetización biológica, formación educacional, ENEM

Introduction

For more than two decades the link between education and the economic development of countries has been spreading. According to World Bank (WB) guidelines, "education should be integrated into the work, to develop the competences needed for development needs' (Fonseca, 1995 cited in Gentilli, 2011, p. 169).

The phenomenon of globalization imposes on future employees the need to master Information and Communication Technologies (ICT), to know how to speak a second language, without leaving aside mastery of the mother tongue (reading and writing), as well as mathematics and science. All this without forgetting the acquisition of transversal competences, where professionals become increasingly well informed, with emphasis on group work, and capable of performing multiple tasks with multidisciplinary knowledge.

From this perspective, the Organization for Economic Cooperation and Development (OECD) is at the heart of the Education 2030 Project. The Project aims to reflect on the type of knowledge, competences, skills, attitudes, and specific values to be developed by students. In addition to this reflection, the OECD has also proposed, through two strands: (1) conceptual framework of relevant learning for 2030 and, (2) international analysis of the curricula of different countries — to make, the OECD (2018) proposes that "global effort for change in education" (p. 7). In the same document, the OECD (2018) mentions "Education needs to aim to do more than prepare young people for the world of work; it needs to equip students with the skills they need to

become active, responsible and engaged citizens" (p. 4). This document lists cognitive and metacognitive skills such as critical thinking, creativity, and learning to learn. In social and emotional competences, empathy, self-efficacy, and collaboration can be highlighted. Practical and physical skills can include, for example, the use of new information and communication technology devices. Therefore, students will need broad and at the same time specialized knowledge. Subjects remain important, but as a basis for teaching by competences and not only as disseminators of concepts.

Based on the OECD's proposal, it is necessary to teach competences and therefore also know how to evaluate them. Assuming that competences are cognitive abilities mobilized to act in certain situations, it is necessary to replace plastered, repetitive, and memorization-based teaching with one that creates conditions for competences to be developed. It is also important to have instruments capable of evaluating the learning (concepts and competences) acquired.

Linked to this question of competences in teaching, one can bring to the debate questions relating to specific competences for each area of knowledge (subjects). Still, within the scope of the specificity of the disciplines, Biology is considered to be one of the disciplines that make choices and makes decisions, because it provides knowledge related to health (basic sanitation, the spread of pathogenic species, how to avoid diseases, etc.) to the environment (natural and built — environmental impacts, natural resources, extinction of species, etc.) and even those related to industrial development (Bionanotechnology, Bioinformatics). Therefore, it is a discipline that covers both the training of scientists to meet the scientific and technological needs of nations as well as citizens capable of acquiring, understanding, and obtaining scientific information and with the ability to express an opinion about it.

Still concerning competences and the discipline of Biology, it is noted that the concept of scientific literacy influences the way to teach and evaluate the contents of it. According to Norris and Phillips (2003), many conceptions of scientific literacy are being used in a broad sense and, therefore, tend to neglect the way scientific literacy is approached in schools. These same authors mention that a simple view of reading and writing (literacy) differs from the fundamental sense of scientific literacy, which must understand the interpretative strategies necessary to deal with the scientific text and, in this respect, has implications for teaching science.

From this perspective, Krasilchik (1988) mentioned two existing aspects of the objectives of science teaching. One aimed at training scientists to meet the need for scientific and technological dominance of nations; the other considered the need to train citizens capable of acquiring, understanding, and obtaining scientific information and with the capacity to express an opinion about it. And, depending on the way a country thinks about scientific education, that is, the purposes defined for the teaching of sciences, the way of teaching (teaching practice) will be conducted.

It is in the context of these themes (competences and scientific literacy) that examinations at the national level also arise with the objective Dias Sobrinho (2010) states "producing changes in curricula, teaching methodologies, training concepts

and practices, management, power structures, institutional models, educational system configurations, research policies and priorities, notions of relevance and social responsibility" (p. 195). Many approaches can be analysed when referring to large-scale exams.

Large-scale exams in Portugal and Brazil have a major implication on the lives of students, parents, and teachers, in the educational process (the way to teach, the way to evaluate, and the contents taught, as found by Silva, Vaz-Rebelo e Canhoto, 2020). In Brazil, ENEM (National High School Exam) in 2019 had 5.1 million enrolled, but were present in the application of the 3.9 million tests, according to the National Institute of Educational Studies and Research Anísio Teixeira (Inep).

In Portugal, students take the "Exam National" exams at the end of the 11th or 12th, in two distinct phases, each year. The test to be taken by the student depends on the course to which it is intended to apply in Higher Education At the end of the 11 years analysed in this research, according to the reports made available by the Directorate General of Education, on its website, 703.980 students took the test of the discipline Biology-Geology (DGE/MEC, n.d).

Properly exploring the interconnections of economics with competences training, scientific literacy, and large-scale examinations, it is pointed out that the universe to be explored in this article will be the relationship between large-scale assessment and the concepts adopted by the official documents of Brazil and Portugal, from the perspective of the competences that are desired to develop in students through the teaching of Biology.

Therefore, it is necessary to clarify: The tests of the "large scale exams" in Portugal and Brazil, through their questions, constitute a method of evaluation that indicates the expected formation, recommended by the program of the discipline Biology-Geology in Portugal and the Curricular Parameters for High School (PCN-EM) in Brazil?

Before explaining the competences present in the official documents of Brazil and Portugal, it is necessary to clarify the reason for choosing the Curricular Parameters for High School (PCN-EM) and the PCN+ (Educational Guidelines Complementary to Parameters) as reference documents for the analysis of this research in Brazilian.

The relevance of Curricular Parameters for High School (PCN-EM) and their implication in educational practices were notorious in Brazil, being these references, indicating the guiding principles of contents, competences and skills to be developed in students.

Vast are the articles that prove these implications. Santos, R. A. (2015) mentions that "[...] the PCN ended up being constituted as guiding documents for the organization/structuring of the existing education systems in Brazil, not only concerning Basic Education but also about training teachers to work in it" (p. 7). Galian (2014) reports that "[...] the PCN resonated strongly with curriculum designers, serving as a guide for the design and development of most Brazilian curriculum proposals" (p. 651)

Despite being presented as guidelines, whose role was to guide educators, the direct or indirect influence that the PCN exerted on the Brazilian curriculum between the years 1997 and 2018 is easily seen in scientific publications. It should be noted here that even with the publication of the National Curricular Guidelines (DCNs), a law that provides general rules for Brazilian basic education, the PCN continued to influence curricula.

Not even the writing of the basic document of the National High School Examination (ENEM) in 2009, whose break with the curriculum set by the PCN is clear, diminished the influencer role of PCN curricula.

In turn, the base document of the ENEM — National Secondary School Examination (MEC, 2002) aimed to "[...] evaluate student performance at the end of basic schooling, to assess the development of fundamental skills for the full exercise of citizenship" (p. 5).

Taking into account that both the PCN's and the ENEM base document brought the perspective of competences to be developed in students and that the research was conceived, written and carried out during the transition period from the PCN's to the National Common Curricular Base (BNCC), passing through the National Curriculum Guidelines (DCN), the choice was to use the PCN's as a reference document for the analyses of this research.

From this point of view, we now present how the competences are described in the guiding documents both in Portugal and Brazil.

Competences Recommended in Portugal's Curriculum

In the Biology subject program and the Law Decree Nº 17/2016, there is an appeal for teaching that praises the laboratory work and the activities of an investigative nature. In the perspective of competences to be developed in the students, the program describes Effort of abstraction and logical reasoning (simplify, order, interpret and restructure information); Experimentation (mastery of experimental procedures); Teamwork (Cooperation and Solidarity) and Weighting and Sense of Responsibility (encourages the development of attitudes of personal and social accountability — criticize, judge, decide) (Amador et al., 2001).

Competences Recommended in Brazil's Curriculum

As for the competences to be developed in Brazilian students are indicated in the National Curriculum Parameters for High School (PCN-EM) and the PCN+ (Educational Guidelines Complementary to Parameters). In these documents, there is an indication of the competences to be developed by the students, in the curricular component of Biology, throughout High School. These competences are explained in three competency sets: Representation and communication; Research and understanding; Social and cultural context. It appears that the document conceives the teaching of Biology as fundamental to developing attitudes and values that promote understanding of the world and action on it and not just provide knowledge of biology. These competences[1] are described below.

1 http://portal.mec.gov.br/seb/arquivos/pdf/CienciasNatureza.pdf

Representation and communication

- Describing processes and characteristics of the environment or living beings, as observed through the microscope or by the naked eye.
- Being able to perceive and use the inherent and specific codes of Biology.
- Raising assumptions and hypotheses about the biological phenomena being studied.
- Presenting the biological knowledge learned in an organized fashion, through texts, drawings, schematics, charts, tables, mock-ups, etc.
- Understanding different forms of access to information (observation, experimentation, text reading, image reading, interview), and selecting those forms that are relevant to the biological topic under study.
- Expressing doubts, ideas, and conclusions about biological phenomena.

Research and comprehension

- Correlating phenomena, events, processes, and ideas in Biology; developing concepts, identifying regular patterns and differences, and developing generalizations.
- Being able to use scientific criteria to classify animals, plants, etc.
- Correlating different conceptual contents in Biology (internal logic) to comprehend phenomena.
- Being able to establish relationships between the part(s) and the whole of a biological phenomenon or process.
- Selecting and using scientific methodologies that are suitable to solve problems, using, when appropriate, statistical treatment in the analysis of the data collected.
- Raising questions, developing diagnoses, and proposing solutions to problems raised by using elements of Biology.
- Using biological notions and concepts in new learning situations (existential or school-based).
- Coordinating the knowledge contents of different disciplines to understand biological events or processes (external logic).

Social and cultural contextualization

- Recognizing Biology as human know-how and, therefore, as a historically determined science, the result of a convergence of social, political, economic, cultural, religious, and technological factors.
- Identifying the interference of mystical and cultural aspects in common sense knowledge related to biological issues.
- Acknowledging human beings as players who drive deliberate transformations in their environment and are at the same time subject to the consequences thereof.
- Assessing intervention actions, identifying those aimed at preserving and implementing individual, collective and environmental health.

- Identifying relationships between scientific knowledge and technological development, considering the preservation of life, the conditions of living, and sustainable development concepts.

Methodology

The empirical study developed involved a documental analysis having as a corpus of analysis the questions of the biology tests of the National Exam in Portugal and the National High School Exam (ENEM) in Brazil. The methodological approach adopted in this study is mixed (quantitative and qualitative) and descriptive since it intends to describe the facts and phenomena of a certain reality (the National Exams and ENEM tests from 2010 to 2016).

Documental Base

The documental base considered in this study consisted of the questions of the biology exams of the National Exam of Portugal, of the 10th and 11th years of secondary schooling, from 2010 to 2016, of the 1st and 2nd phases and, in the case of Brazil, of the questions of the ENEM exams in the same period, of the discipline Biology, which falls within the area of Nature Sciences and its Technologies.

The Portuguese examinations were obtained through the book published by the Editorial of the Ministry of Education and Science of Portugal, called EMEC, which contains questions and examination resolutions. Access to the 2016 exam was through the official database of the Institute for Educational Evaluation (IAVE). In addition to the National Examinations, on the website of the General Directorate of Education (DGE) of the Ministry of Education (MEC), the Biology Program for the 10th and 11th years was obtained.

The ENEM exams were obtained on the Inep website. After downloading the exams, the first process was to select, among the 45 questions of the Nature Science and its Technologies exam, those exclusively for Biology. This process is possible through the classification of the questions by competences associated with the content of the questions, made by Inep itself and made available in the database (micro-data in CSV format) on the website of the institution.

Still, regarding the ENEM questions, it is worth mentioning that the evaluation methodology used is the Theory of Reply to the Item (TRI). This methodology can be understood according (Andrade et al., 2000), as "a set of mathematical models that seek to represent the probability of an individual giving a certain response to an item as a function of the item parameters and the ability (or abilities) of the respondent" (p. 7). In addition to this methodology, there is also care in the preparation of items (questions). The ENEM items are prepared by specialists selected through a public call from the National Institute of Educational Studies and Research Anísio Teixeira (Inep). The selected experts follow the reference matrix and a guide for preparing and reviewing items, both established by Inep. After writing, the items then pass through reviewers to compose the National Bank of Items (BNI) of Inep.

Content Analysis

The content analysis process was based on the three phases suggested by Bardin (2002): (1) pre-analysis; (2) exploration of the material; and (3) treatment, inference, and interpretation. These steps were performed using Atlas.ti software (version 8.0). Its use aimed to increase the level of accuracy and facilitate the manipulation of information.

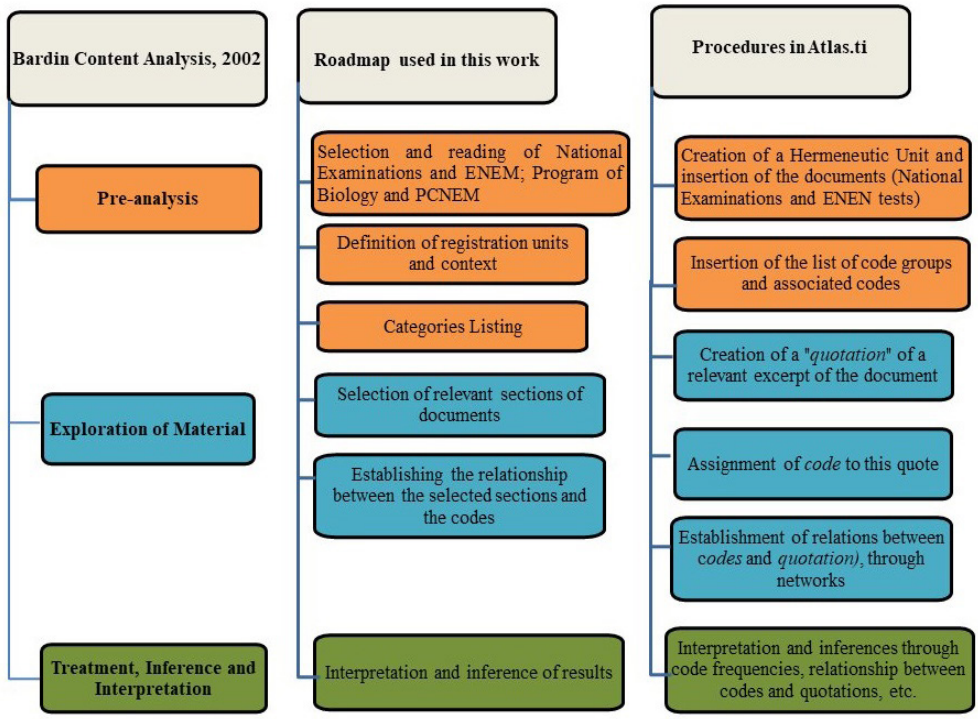
To start the analysis procedures in the Atlas.ti software, a Hermeneutic unit was created and the documents (National Examinations and ENEM tests) were inserted. Then, the process of inserting the code in the software was started, since these were established a priori. There was also the insertion of the list of categories that were associated with the codes.

Subsequently, sections of the exam questions were selected, creating a "quotation" of a relevant section and assigning a "code" to that quotation. In other words, the analysis took place through the selection of the passage of the question in which a command is given to the student (associated with instruction when this existed). Subsequently, the code groups were analysed through the respective code, identifying the frequencies of occurrence of each code. Regarding inference and interpretation, these occurred from the reports generated by Atlas.ti software. The procedure was the same for ENEM.

Figure 1 makes a parallel between the procedures in the Atlas.ti software and content analysis by Laurence Bardin (2002), both in the National Exam and in ENEM.

Figure 1

Analogy of the Document Analysis Process in the Manual Step and the Use of Atlas.ti software



The units of registration and context defined were: Context Unit = National Exam Questions and ENEM (Enunciate and the alternatives of the questions provided for the candidates' choice). Registration Unit = the command given to the student to solve the question (of the National Exams and ENEM).

Regarding the categorization of data, we opted for an a priori analysis, that is, the categories were predetermined according to the search for the specific answer of this study, presented in the introduction of this article. Thus, the Programs of the discipline of Biology for the 10th and 11th years of high school in Portugal and the National Curricular Parameters for High School (PCN+) in Brazil were considered as the matrix that generated the categories of this work. In Figure 2, the categories are presented, as well as the subcategories and the meaning correspondence of each of them.

Figure 2

Description Categorization for Content Analysis

Categories	**Subcategories**	**Sense Correspondence**
Cognitive knowledge	Simplify information	Reproduce the thought or sense of something exposed
	Sort information	Determine the relationship or correlation between situations, categories and variables Establish the precise order in which a particular element appears
	Interpreting the information	Employing the required concepts in a given field
	Restructure information	Use the concept in the context of an inflicted situation
	Memorize information	Recognize and reproduce ideas and content
Scientific knowledge	Understand and investigate phenomena	To infer, through concepts and knowledge of methods, criteria and techniques specific to scientific research
	Evaluate evidence	
	Identify a scientific research problem	
	Understanding the structure of scientific research	
Social and behavioural knowledge	Cooperation and solidarity	Assess situations of the individual or collective scope
		Encourages the development of personal and social responsibility attitudes (criticize, judge, decide)

The coding process, using the keywords/indicators, described in Figure 3, was established through the correspondence between the linguistic or syntactic structures and the questions of the tests. It should be noted that the use of verbs for most questions is related to the command given to the student to answer a question made in the tests of both National Exams.

Figure 3

Description of the Indicators Used for the Content Analysis of National Examinations questions (2010–2016)

Categories	**Subcategories**	**Indicators**
Cognitive knowledge	Simplify information	explain/explain identify/identify select/select
	Sort information	match/correspond sort/order relate/relate
	Interpreting the information	consider/consider conclude/conclude
	Restructure information	develop/develop foundation/depth
	Memorise information	define/define say list/list name/name
Scientific knowledge	Understand and investigate phenomena	phenomena under controllable conditions (experience)
	Evaluate evidence	interpret data
	Identify a scientific research problem	recognize hypotheses
	Understanding the structure of scientific research	understand the experimental procedures (control, investigation)
Social and behavioural knowledge	Recognize the development of personal and social responsibility attitudes	divide/divide share/share decide/decide criticize/critique
	Compare different points of view expressed	Influence/influence
	Evaluate proposals of the individual or collective scope	judge/judge

The final stage of the study consisted of enumerating the indicators using the survey of the number of their occurrences, followed by inference and interpretation. As already mentioned, the inferences occurred from the reports generated by Atlas.ti software. The procedure was the same as ENEM.

Over the 7 years evaluated by this study, 111 questions were analysed by the National Exam of Biology in Portugal and 114 in Brazil. All of them demanded knowledge of Biology.

Analysis of Competences and Skills Classified by Inep in ENEM Questions

Regarding ENEM, besides the analysis in Atlas.ti, there was a quantitative analysis of the competences and skills required in ENEM questions. The objective of this analysis was to find out which of the competences stipulated in the reference matrix[2] ENEM has been more required.

This analysis was performed through the quantification of the questions by competences in Microsoft Office Excel®. Inep itself makes available, on the institution's website, a database (micro-data in CSV format) with the questions already classified by skill and associated with a content area. Thus, the competences could be identified, because each skill is associated with competences in this same matrix.

The competences were identified with the letter "C" and its respective number and the abilities with the letter "H" and its respective number. The questions analysed were always those related to the "yellow notebook" from 2010 to 2016. It should be noted that of these competences ones number 2, 6, and 7 were not included in the categorization, as they bring competences exclusively related to the areas of physics and chemistry.

Results

The analysis of the National Examinations in Portugal took place both for the 1st phase and the 2nd phase of the exam, so the results are also presented according to these phases. In Brazil, where there is no second opportunity to take the exam (except for eventual mistakes of the applicator — Inep), first, the results obtained through the software Atlas ti are presented, and later those analysed through Microsoft Office Excel® (skills and competences classified by Inep).

Competences Required in the Exams of the 1st Phase in Portugal

Regarding the competences required of students, in solving the questions of the National Exams of the 1st stage, it can be seen that the category is predominant "cognitive knowledge" with 86% of the questions of the National Exams focused on this type of competence, followed by "scientific knowledge" with 14%. It is also verified that there is an unequal distribution of the types of competence, being required only two (scientific and cognitive) of the three analysed.

Utilizing a correlation table between codes, the frequencies of occurrence of each code can be identified (Table 1).

2 Guide document that establishes the contents, skills, and competences of each area needed to solve the questions.

Table 1
Frequencies of the Codes Analysed in the questions of Biology of the Chronological series under Study

Competences/ Code groups	Subcategories	Indicators/Codes	1st Phase	
			Grounded*	Frequencies (%)**
Cognitive Knowledge	Simplify information	explain	15	14
		identify	11	10
		select	0	0
		Total	26	**24**
	Sort information	match/correspond	4	3
		sort/order	7	6
		relate	5	4
		Total	16	**13**
	Interpreting the information	consider	1	1
		conclude	13	12
		Total	14	**13**
	Restructure information	develop	0	0
		grounding/funding	7	6
		Total	7	**6**
	Memorise information	define	1	1
		say	25	**24**
		list	0	0
		name	6	5
		Total	32	**30**
Scientific Knowledge	Understand and investigate phenomena	Observing phenomena	0	0
	Evaluate evidence	Interpreting data	9	8
	Identify a scientific research problem	Recognize hypotheses	1	1
	Understanding the structure of scientific research	Understand experimental procedures	6	5
		Total	16	**14**
Social and behavioural knowledge	Recognize the development of personal and social responsibility attitudes	share		
		criticise/critique	0	0
		decide	0	0
		divide	0	0
		Total	0	0
	Compare different points of view expressed	Influence	0	0
	Evaluate proposals of individual and collective scope	judge	0	0
		Total	0	0

Note 1. *The number indicates the number of times the code was applied in the tests.
Note 2.**Frequencies about the total of questions (111) analysed.
Source: Elaborated by the authors from the Atlas.ti software database — version 8.0 (HU Questions National Exams Portugal — phase 1).

In terms of cognitive knowledge, the subcategory "memorizing information" presented 30% of the occurrences. Then "simplify information" with 24%. "classify information" and "interpret the information" tie at 13%. Finally, with 6% of the occurrences, it was "restructuring information".

From the analysis of the codes, "say/tell" with 24%, followed by "explain/explain" with 14%, "conclude/conclude" with 12%, and "identify/identify" with 10%.

The subcategory "remember information" requires the student to remember facts, dates, words, theories, methods, classifications, places, rules, criteria, procedures, etc. To use this competence, the student has to remember a significant amount of information or just specific facts. Figure 4 shows an example of a question that requested the student to only memorize.

Figure 4

Question Requiring Students to Memorization

Group II

4. With regard to *Fragaria vesca*, *Fragaria daltoniana* and *Agrostis vesca*, it can be said that — **Command given to the student**

(A) Fragaria vesca and *Agrostis vesca* belong to distinct species of the same genus.

(B) Fragaria daltoniana and *Fragaria vesca* belong to distinct species of the same family.

(C) Fragaria vesca and *Agrostis vesca* belong to the same species and the genus vesca.

(D) Fragaria daltoniana and *Fragaria vesca* belong to the same species and the genus Fragaria.

Alternatives for answer

Source: Exam BG702, phase 1, version 1 of the 2014 National Exam, question 4, Group II, p. 7. Translated by the authors. The Portuguese Government's Open License.

In the only sentence of the question, there are three scientific names and the command given to the student, which uses the verb "to affirm" in the sense of "declare to be true". The cognitive domain requested is that of memorization (a rule), that is, taxonomic, where living beings are organized into hierarchical categories or taxons. Knowing the rule, it is possible to "affirm" to which genus, family, or species a given living being belongs. Another way of writing the question would be: Mention (say) to which family *Fragaria daltonian* and *Fragaria vesca* belong and if they are of the same species or not.

Regarding the competence of "scientific knowledge", there was only 14% frequency in the total of questions analysed (111), therefore a low number of questions related to this category. Among the codes, "Interpret data" appears with 8% and "Understand experimental procedures" with 5% frequency. An example of a question that required "scientific knowledge" from the student is depicted in Figure 5.

Figure 5

Question that required from the student "scientific knowledge"

Group II

In the 1960s, experiments involving the fusion of mammalian cells at different times during interphase allowed the regulation of the onset of DNA synthesis and the initiation of mitosis in the cell cycle to be investigated. } **Affirmation**

After isolating populations of cells, in G1 period (G1 cells), in G2 period (G2 cells) and at the end of S period (S cells), we proceeded to perform two types of experiments involving the fusion between cells from different populations, obtaining binucleated cells. In both types of experiments, the S cells were previously labelled with tritiated thymidine, in order to allow their identification in the hybrids resulting from the fusions. Tritiated thymidine consists of thymine, labelled with atoms of tritium (a radioactive isotope of hydrogen) in its methyl group, and a pentose.

Experiment 1 - Study of the regulation of the initiation of DNA synthesis in fused cells.

On different discs containing culture medium with tritiated thymidine and colcemide*, the following cell populations were placed: unfused G1 cells (G1), G1 cells fused to each other (G1/G1), and G1 cells fused to S cells (G1/S).

Graph 1 shows the variation in the percentage of labelled cells in each disk over 16 hours.

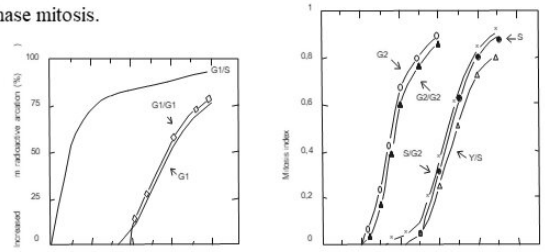
Experiment 2 - Study of the regulation of mitosis initiation in fused cells.

On different discs containing culture medium with colchemide, the following cell populations were placed: unfused G2 cells (G2), G2 cells fused to each other (G2/G2), unfused S cells (S), S cells fused to each other (S/S), and S cells fused to G2 cells (S/G2).

Graph 2 shows the variation of the mitosis index (obtained by dividing the number of cells in mitosis by the number of cells counted) over 18 hours.

* The use of colchemide was intended to block metaphase mitosis.

} **Student support (text, figure, table, etc.)**



Graph 1 Graph 2

Baseado em Rao, P. N. e Johnson, R.T., "Mammalian Cell Fusion: Studies on the Regulation of DNA Synthesis and Mitosis", *Nature*, vol. 225, 1970

1.1 Name the disks that serve as controls in experiment 1. } **Command given to the student**

Source: Exam BG702, phase 1, version 1 of the 2013 National Exam, question 1.1. Group II, p.6. Translated by the authors. The Portuguese Government's Open License.

Corroborating the result found in this research, Maia and Justi (2008) in a work where were analysed the evaluations developed by four mass evaluation programs of several countries (or groups of countries): Third International Mathematics and Science Study (TIMSS); Programme for International Student Assessment (PISA); National Assessment of Educational Progress (NAEP) and National Examination of Secondary Education (ENEM). Maia e Justi (2008) highlighted the difficulty of evaluating research competences, especially those related to the stages of 'modelling', 'analysis' and 'communication' of the research cycle, presenting few opportunities for the explanation of knowledge related to them (p. 447).

It should be noted that these questions play an important role in the exams, as it is one of the means of ascertaining whether the student is acquiring and developing scientific knowledge, understanding how and why scientific claims are validated, and explaining and reasoning with models. This group includes questions that make use of

analysis of graphs and tables, whose interpretation and correlation of data are fundamental for the elaboration of claims/conclusions that are specific to the context. Thus, they are questions that require the use of different competences in solving questions.

Competences Required in the Exams of the 2nd Phase of Exam in Portugal

As in the first phase of the Exam, in the 2nd phase of the National Exam, the categories (Code Groups) were also analysed through the respective code in the Atlas.ti software.

With the results obtained, a domain of questions that privileged cognitive knowledge was found, with 85% of the questions focused on this type of competence to the detriment of other competences. It is interesting to observe a slight increase in "scientific knowledge" in the second phase of the Exam, from 14% in the first phase to 15% in the second period of this research.

The analysis of the categories (Code Groups) in the software Atlas.ti allowed identifying the frequencies (Table 2) of each code about the questions in the second phase of the National Exam.

Table 2

Frequencies of the codes analysed in the questions of Biology of the chronological series under study

Competences/ Code groups	Subcategories	Indicators/Codes	2nd Phase	
			Grounded*	Frequencies (%)**
Cognitive Knowledge	Simplify information	explain	**12**	**11**
		identify	**10**	**9**
		select	**0**	**0**
		Total	**22**	**20**
	Sort information	match/correspond	12	11
		sort/order	7	6
		relate	6	5
		Total	25	**22**
	Interpreting the information	consider	0	0
		conclude	15	14
		Total	15	**14**
	Restructure information	develop	0	0
		grounding/funding	3	3
		Total	3	3
	Memorize information	define	4	3
		say	18	17
		list	0	0
		name	7	6
		Total	29	**26**

Table 2

Frequencies of the codes analysed in the questions of Biology of the chronological series under study (continuation)

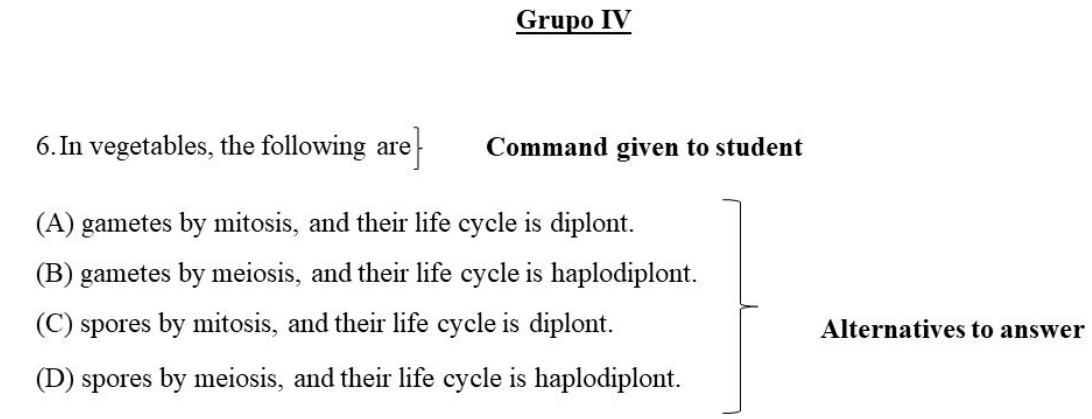
Competences/ Code groups	Subcategories	Indicators/Codes	2nd Phase	
			Grounded*	Frequencies (%)**
Scientific Knowledge	Understand and investigate phenomena	Observing phenomena	1	1
	Evaluate evidence	Interpreting data	12	11
	Identify a scientific research problem	Recognize hypotheses	0	0
	Understanding the structure of scientific research	Understand experimental procedures	4	3
		Total	17	**15**
Social and behavioural knowledge	Recognize the development of personal and social responsibility attitudes	share		
		criticize/critique	0	0
		decide	0	0
		divide	0	0
		Total	0	0
	Compare different points of view expressed	Influence	0	0
	Evaluate proposals of individual and collective scope	judge	0	0
		Total	0	0

Note 1. *The number indicates the number of times the code was applied in the tests;
Note 2. ** Frequencies about the total of questions (111) analysed.
Source: Elaborated by the authors from the Atlas.ti software database — version 8.0 (HU Questions National Exams Portugal — phase 2).

Considering the results obtained in the cognitive knowledge subcategory, it appears that "memorizing information" is the highest occurrence, with 26% of the questions focused on this type of competence, followed by "ordering information" (22%). When it comes to "simplifying information", 20% of the questions represent this subcategory. As far as interpreting the information is concerned, 14% of the frequencies are observed. Among the codes, "say/say" with 17% of the occurrences, followed by "conclude/conclude" with 14%. With the same frequency, we have "explain" and "correspond" with 11%. To exemplify a question that asked the student only to memorize in the second phase of the National Examination, we have figure 6.

Figure 6

Sample question from the National Exam in Portugal requiring students to memorize — phase 2



Source: Exam BG702, phase 2, version 1 of the 2013 National Exam, question 6, Group IV, p. 13. Translated by the authors. The Portuguese Government's Open License.

The cognitive domain requested in the above example is that of memorization (theory), the student needed to remember the difference between mitosis and meiosis, as well as the type of life cycle (haplodon or diplodon). Another perceptible situation in the question is that if the student does not know beforehand the meaning of each of the alternatives of the question, he cannot solve it, because these (answer alternatives) also need previous knowledge. The command for the solution to the question was elaborated implicitly (hidden verb — "say from the verb to say" how the gametes are formed in the legumes and what is their life cycle (gametes).

The National Exams Portugal, in the period analysed by this research, was guided in questions related to the understanding of concepts, involving a higher level of cognitive demand, requiring the explanation of a more refined knowledge, by the student, of some of the contents, addressed. But it also appears that a high number of questions demanded from the students only access to previous knowledge (memorization) and/or information made available by the enunciation of the question itself (knowledge of facts).

Competences and Skills Required in ENEM

Competence Analysis Through Atlas.ti

The analysis of content through the Atlas.ti regarding the competences required of students in solving ENEM questions took place through the analysis of the categories (Code Groups) through the respective code in the Atlas.ti software.

As in the National Exams of Portugal, there is a field of questions that have privileged the cognitive knowledge in ENEM. The occurrence is even greater, with 96% of the questions focused on this type of competence to the detriment of the other

competences investigated. However, it is pointed out that the competences tested in ENEM are associated with several competences in the reference matrix that, in turn, are expressed in action verbs, such as analyse, identify, recognize, select, compare, etc.

It can be seen from the data in table 3 that, with an appreciation of the subcategories associated with each code, observed that the subcategory "simplify information" is the one with the highest occurrence, with 32%, followed by "memorization" with 28% of the questions and "interpret the information" with 19%. "Restructuring information" obtained only 3% of occurrences. All these subcategories make up the cognitive knowledge category, which explains the high percentage of this group of questions. However, it should be noted that each of the subcategories requires different cognitive operations from students and, therefore, different explanations of knowledge. In this sense, Perrenoud (1999) defines competence as the "ability to act effectively in a given type of situation, supported by knowledge, but without being limited to it" (p. 7), that is, there is no way to dissociate competence from knowledge (contents).

Table 3

Frequencies of the codes analysed in the questions of Biology of the chronological series under the study of the ENEM

Competences/ Code groups	Subcategories	Indicators/Codes	Grounded*	Frequencies (%)**
Cognitive Knowledge	Simplify information	explain	11	10
		identify	15	13
		Select	10	9
		Total	36	**32**
	Sort information	match/correspond	9	8
		sort/order	0	0
		relate/relate	7	6
		Total	16	**14**
	Interpreting the information	consider	2	2
		conclude	20	17
		Total	22	**19**
	Restructure information	Develop	0	0
		grounding/funding	4	3
		Total	4	**3**
	Memorise information	Define	2	2
		Say	13	11
		List	4	4
		Name	13	11
		Total	32	**28**

Table 3

Frequencies of the codes analysed in the questions of Biology of the chronological series under the study of the ENEM (continuation)

Competences/ Code groups	Subcategories	Indicators/Codes	Grounded*	Frequencies (%)**
Scientific Knowledge	Understand and investigate phenomena	observe phenomena	1	1
	Evaluate evidence	interpret data	1	1
	Identify a scientific research problem	recognize hypotheses	1	1
	Understanding the structure of scientific research	understand experimental procedures	1	1
		Total	4	**4**
Social and behavioural knowledge	Recognize the development of personal and social accountability attitudes	Share	0	0
		criticize/critique	0	0
		decide	0	0
		Divide	0	0
		Total	0	**0**
	Compare different points of view expressed	Influence	0	0
	Evaluate proposals of individual and collective scope	Judge	0	0
		Total	0	**0**

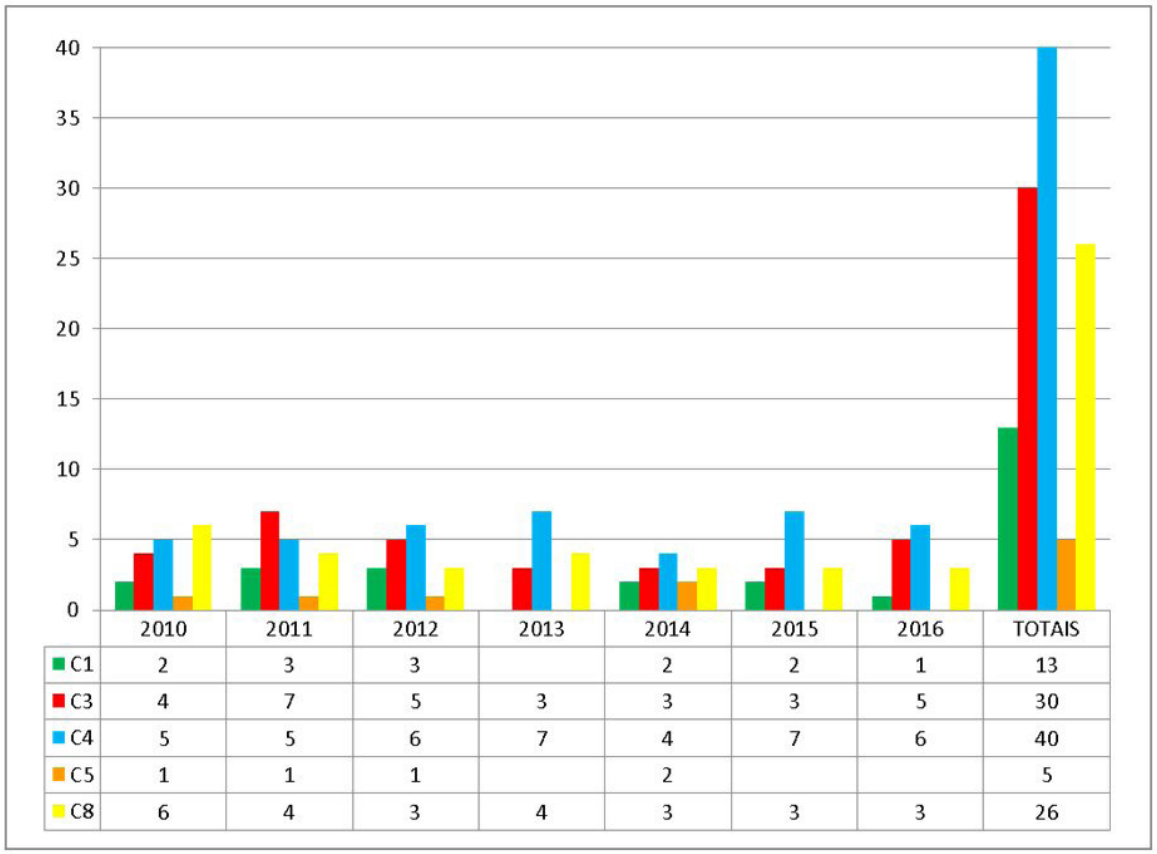
Note 1. *The number indicates the number of times the code was applied in the tests;
Note 2. **Frequencies about the total of questions (114) analysed.
Source: elaborated by the authors, from the database in the Atlas.ti software — version 8.0 (HU ENEM Questions).

Regarding the scientific knowledge category, only 4% of the questions were observed, demonstrating a very small frequency of questions focused on the competence "scientific knowledge" in the ENEM tests, in the period investigated by this research.

Analysis of Competences Classified by Inep

Figure 7

Competences Required of Students to solve ENEM Questions between 2010 and 2016



	2010	2011	2012	2013	2014	2015	2016	TOTAIS
C1	2	3	3		2	2	1	13
C3	4	7	5	3	3	3	5	30
C4	5	5	6	7	4	7	6	40
C5	1	1	1		2			5
C8	6	4	3	4	3	3	3	26

Source: Elaborated by the authors, through the data obtained from the Inep database. Valid creative commons license.

As shown in Figure 7, quantitatively (absolute frequency), it is possible to verify that competence 4 was the most demanded in the evaluated tests, appearing in 40 of the 114 questions inspected, representing 35.1% of the total questions. competence 3, followed by competence 8 and 1, are the ones that most appear with 30, 26, and 13 questions, respectively. Competency 5 was the least required, appearing in only five questions.

Examining Competence 3 described for Inep (2015) as "Associate interventions that result in environmental degradation or conservation to productive and social processes and scientific-technological instruments or actions" (p. 8), it is verified that it is a competence that requires the understanding of the diverse forms with which the human being relates to the environment, that is, it is necessary to identify the actions and processes that can maintain or alter the local and global balance. Thus, it is also observed that it is a competence that allows the student to make a reflective exercise on the ethical aspects of scientific and technological productions.

Competence 4 is referred to in MEC (2002) as "Understanding interactions between organisms and the environment, particularly those related to human health, relating scientific knowledge, cultural aspects and individual characteristics" (p. 9). That is, it is a competence that requires the integration of knowledge from the various sub-areas of Biology. Besides the interactions with social elements, affect human groups. Thus, it makes sense that competences 3 and 4 are the most requested because all these characteristics facilitate testing the cognitive skills (thinking, reasoning, perceiving, and taking implicit information of questions) of the candidate. In other words, there is an interdisciplinary assessment and contextualization in daily situations, which is different from an organization based on discipline, thus meeting the demands and assumptions of ENEM.

From the perspective of the competences per year of test application, it can be seen that competence 8, considered exclusive to the knowledge of Biology by Inep itself, appears prominently only in 2010. There was, therefore, no predilection for the discipline of biology itself. This fact can be disadvantageous, especially in the sense of scientific literacy; by not charging students the need for a significant appropriation of content (concepts, procedures, languages) proper to Biology. Thus, ENEM fails to test the acquisition of competences related to scientific literacy, in the case of the biology discipline.

Inep/MEC (2005) mentions that the ENEM is structured in the "measurement of the mental structures with which we continually build knowledge" (p. 7). For this purpose, the evaluation takes into account not only the specific competences and skills of each area but also those common to all areas, the so-called cognitive competence, being: mastering the cultured norm of the Portuguese language, understanding natural phenomena, facing problem situations, building consistent arguments and elaborating proposals that pay attention to social issues.

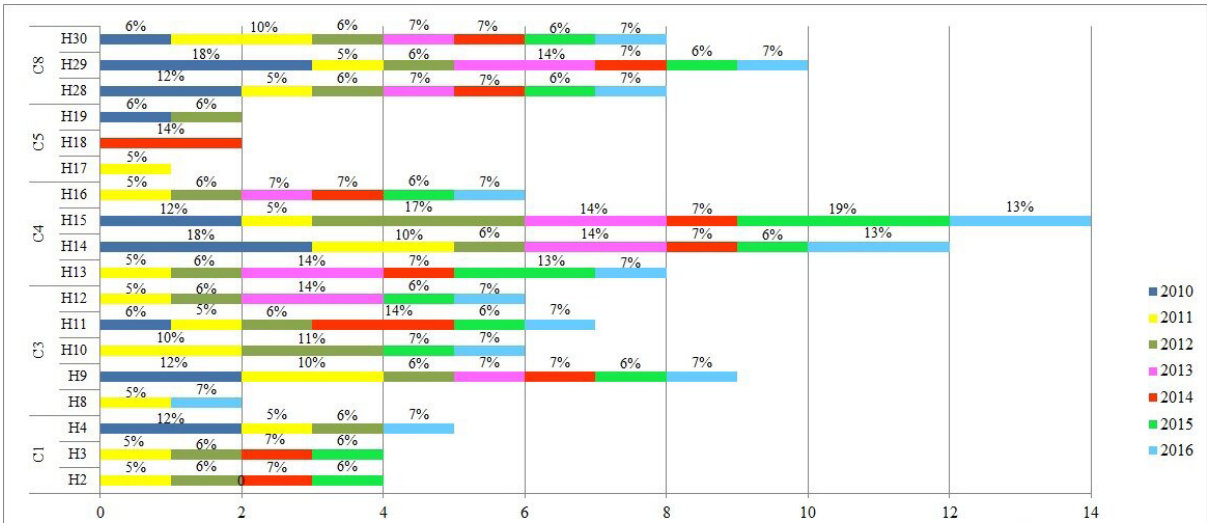
Corroborating with the results found, both (J. Santos & Cortelazzo, 2013) and (Sapatini, 2014) found in their work the highest frequency of competence 4 in their analysis of nature science issues of ENEM.

Analysis of Skills Classified by Inep

When calculating the absolute frequencies of each skill required of students in ENEM (Figure 8), calculated according to the total number of biology questions requested per year, it appears that, as with competences, there is no balance or regularity concerning certain skills, for many of them did not even appear in the analysed exams.

Figure 8

Skills Required of Students in ENEM (2010–2016)



	C1			C3					C4				C5			C8		
	H2	H3	H4	H8	H9	H10	H11	H12	H13	H14	H15	H16	H17	H18	H19	H28	H29	H30
2010	0	0	2	0	2	0	1	0	0	3	2	0	0	0	1	2	3	1
2011	1	1	1	1	2	2	1	1	1	2	1	1	1	0	0	1	1	2
2012	1	1	1	0	1	2	1	1	1	1	3	1	0	0	1	1	1	1
2013	0	0	0	0	1	0	0	2	2	2	2	1	0	0	0	1	2	1
2014	1	1	0	0	1	0	2	0	1	1	1	1	0	2	0	1	1	1
2015	1	1	0	0	1	1	1	1	2	1	3	1	0	0	0	1	1	1
2016	0	0	1	1	1	1	1	1	1	2	2	1	0	0	0	1	1	1

Source: Elaborated by the authors, through the data obtained from the Inep database. Valid creative commons license.

A temporal analysis of the data shows that the years 2011 and 2012 were the years with the highest number of skills requested from students, 16 and 15 respectively. Another finding is that skills 14 (H14) and 15 were the only ones with occurrences in the whole period analysed by this research and those with the highest absolute frequencies, 12 and 14 occurrences, respectively, in the analysed questions. Skill 17, on the other hand, presented only one occurrence in the same period.

When analysing skills 14 (H14) and 15 (H15), we verified that these are linked to competence 4, which also includes competence 13 (8 occurrences) and 16 (6 occurrences). They were the competences with more occurrences in the editions evaluated by this research.

By this way of understanding, the skill 14 (H14), described in the reference matrix of ENEM as "Identify patterns in vital phenomena and processes of organisms, such as maintenance of internal balance, defence, relations with the environment, sexuality, among others" and the skill 15 (H15) "Interpret models and experiments to explain biological phenomena or processes at any level of organization of biological systems" converge to the set of knowledge, capabilities and aptitudes that qualify students in understanding, elaboration and explanations necessary to solve the questions, and acting on the world around them.

When the skills (28, 29, and 30) related to competence 8, exclusive to biology, are approached, it can be seen that, besides having been requested by the students in all the editions evaluated by this research, they also presented a more homogeneous distribution of occurrences among the 3 skills related to it. This contrasts with competence 4, which concentrated the occurrences in 2 of the 4 skills that compose it. Therefore, the results found in the analysis of the abilities are coherent with the results obtained in the analysis of the competences.

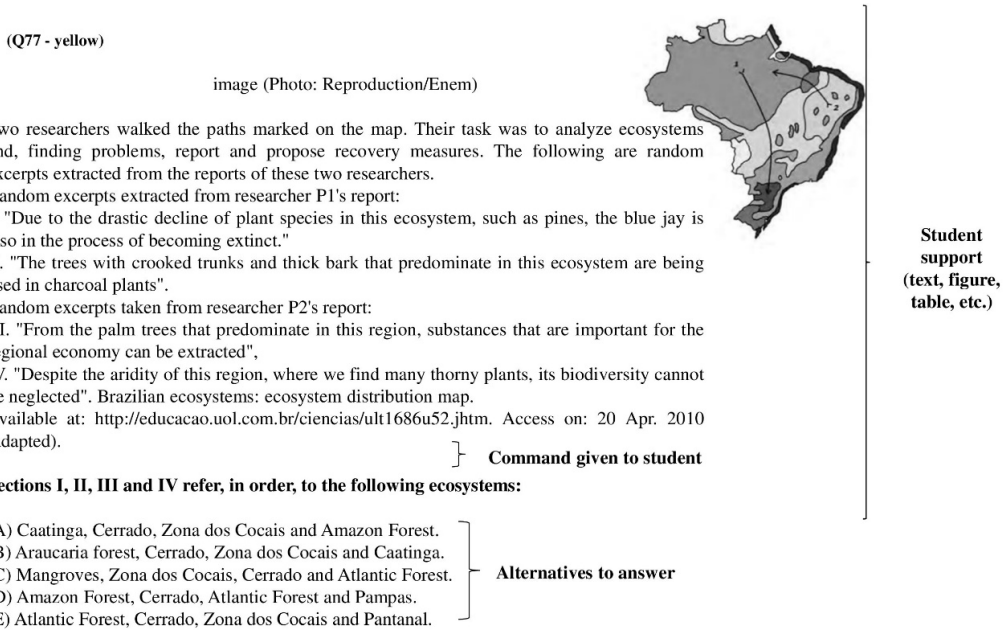
It is interesting to verify that skill 8 (H8) — "Identify steps in processes of obtaining, transforming, using or recycling natural resources, energy or raw materials, considering biological, chemical or physical processes involved in them" is requested only twice, one in 2011 and one in 2016, despite the competence 3, to which it is linked, be the second most requested to students in the editions evaluated by this research.

Another situation that calls attention is the fact that skill 17 (H17) was requested only once and skills 18 (H18) and 19 (H19) were requested twice during the period evaluated. These skills are linked to competence 5 — "Understand methods and procedures proper of natural sciences and apply them in different contexts. Such a situation is, at least, incoherent since what is expected from a natural sciences test, which includes biology, physics, and chemistry is to evaluate the students in their ability to understand methods and procedures proper of the natural sciences.

Question 77 of ENEM (Figure 9) exemplifies a question that required the student's ability 28 — "To associate adaptive characteristics of organisms with their way of life or with their limits of distribution in different environments, especially in Brazilian environments". It is noted that it is an easy question, as long as the student knows the plant formations of the Brazilian territory. It is also perceived that it is a well-defined question, to meet the specificity of a particular skill.

Figure 9

Question that required the student's skill 28



Source: ENEM Pedagogical Report 2009–2010. Translated by the authors. Valid creative commons license.

Conclusions and Implications

Taking into account the results obtained in this study, it can be observed that, in Portugal, the program advocates learning focused on the student and that the student must build a solid mastery not only of knowledge (concepts, models, and scientific theories) and reasoning (organize and analyse information, evaluate results) but also of attitudes and values (responsibility, reflection, collaboration). However, in the National Examinations analysed in the context of this work, there was a scarcity of questions that presented daily problem situations, requiring logical reasoning and, at the same time, requesting specific knowledge of content. These questions would be closer to the current teaching demands. The questions focused mostly on academic content and aptitudes.

Thus, it seems obvious to us that, in the period analysed by this research, there is a mismatch between the objectives of the BG702 exam of the National Exam and the Biology-Geology program (scientific-humanistic course of Sciences and Technologies) for the 10th and 11th grades in Portugal, Given that the program of DGE/MEC (2001) establishes as its purpose "the construction of a solid biological literacy", whose "strengthening of abstraction capacities, experimentation, teamwork, consideration and sense of responsibility will allow the development of skills that characterize Biology as Science" (pp. 66–67).

In Brazil, the test also has a high number of questions that require students only access to previous knowledge (memorization) and/or information made available by the enunciation of the question itself (knowledge of facts). Of the competences recommended in the PCN+, those that were contemplated, even if indirectly were: "Identify in a given problem situation the relevant information or variables and possible strategies to solve them"; "Select and use measurement and calculation instruments, use scales, make estimates, elaborate hypotheses and interpret results"; "Recognize, use, interpret and propose explanatory models for natural or technological phenomena or systems".

The analysis made by this research, referring to competences required of students in large-scale exams both in Portugal and Brazil, highlighted the difficulty in using multiple choice questions to test the various academic aptitudes, predominating the cognitive ones. From this perspective, Melchior (2012) contributed to the recognition of citizenship values to be emphasized in the definitions of competences and skills. However, he also recognized that these values still need to be taken into account in the institution selection processes and the training parameters of newcomers to higher education.

One study by Greaney and Kellaghan (2011), argues that "although it is generally accepted that life skills are important and should be taught, there is a lot of disagreement about their exact nature. Its measurement has also proved difficult" (p. 39).

In another study, Carroll (1993) showed the presence of different cognitive levels, associated with different types of skills (specific and specialized). So different nuances of large-scale assessment need to be taught and improved to reach a bigger goal than just ranking and selection for the top level.

The concern in the usefulness of knowledge, as well as the teaching method, is something that concerns several countries, mainly when it comes to Science and Technology. Looking from this perspective, the development of competences focused on decision-making, which must be guided by attitudes and values of responsibility, reflection and collaboration seems to be largely left aside. It should be noted that, although education alone does not solve the problems of a country's economy, it is the basis for this development to occur.

Given the results achieved, it is clear that it is not enough to develop/reinforce students' skills through learning strategies and curriculum adequacy if the internal and external evaluation instruments are unable to ascertain whether these (skills) are being developed in students. Thus, the educational system in both Portugal and Brazil has as a challenge, an evaluation of learning (Assessment as Learning) and not simply the evaluation of learning (Assessment of Learning).

It is concluded, therefore, that the examinations on a large scale in Portugal and Brazil do not seem very suitable to promote the training described in the official documents of both countries.

References

Amador, F., Silva, C. P., Baptista, J. P., Valente, R. A., Mendes, A., Rebelo, D., & Pinheiro, E. (2001). *Programa de Biologia e Geologia 10º ou 11º Anos*. Ministério da Educação. https://www.dge.mec.pt/sites/default/files/Secundario/Documentos/Programas/Recorrente/bio_geo_10_11.pdf

Andrade, D. F., Tavares, H. R., & Valle, R. C. (2000). *Teoria da resposta ao item: conceitos e aplicações*. Associação Brasileira de Estatística. https://docs.ufpr.br/~aanjos/CE095/LivroTRI_DALTON.pdf

ATLAS.ti Scientific Software Development GmbH (2016). *ATLAS.ti* (qualitative data analysis — version 8.0) [Computer Software]. https://atlasti.com/

Bardin, L. (2002). *Análise de conteúdo*. Edições 70.

Carroll, J. B. (1993). *Human cognitive abilities: A survey of factor-analytic studies*. Cambridge University Press. https://doi.org/10.1017/CBO9780511571312

Direção Geral de Educação (DGE) (n.d). Relatórios/Estatísticas [Reports/Statistics]. https://www.dge.mec.pt/relatoriosestatisticas-0

Dias Sobrinho, J. (2010). Avaliação e transformações da educação superior brasileira (1995–2009): Do provão ao SINAES. *Avaliação: Revista da Avaliação da Educação Superior*, *15*(1), 195–224. http://periodicos.uniso.br/ojs/index.php/avaliacao/article/view/341

Galian, C. V. A. (2014). Os PCN e a elaboração de propostas curriculares no Brasil. *Cadernos De Pesquisa*, *44*(153), 648–669. https://publicacoes.fcc.org.br/cp/article/view/2812

Gentilli, P. (Org.) (2011). *Pedagogia da Exclusão: Crítica ao Neoliberalismo em Educação*. Vozes.

Greaney, V., & Kellaghan, T. (2011). *A avaliação dos níveis de desempenho educacional*. Elsevier.

Instituto Nacional de Estudos e Pesquisas Educacionais Anísio Teixeira (Inep). (2005). *Exame Nacional do Ensino Médio (ENEM): Fundamentação Teórico-Metodológica*. Ministério da Educação. https://www.gov.br/inep/pt-br/centrais-de-conteudo/acervo-linha-editorial/publicacoes-institucionais/avaliacoes-e-exames-da-educacao-basica/fundamentacao-teorico-metodologica

Instituto Nacional de Estudos e Pesquisas Educacionais Anísio Teixeira (Inep). (2009). *Matriz de Referência do ENEM*. https://download.inep.gov.br/download/enem/matriz_referencia.pdf

Instituto Nacional de Estudos e Pesquisas Educacionais Anísio Teixeira (Inep). (2015). *Relatório Pedagógico ENEM 2011–2012*. https://www.gov.br/inep/pt-br/centrais-de-conteudo/acervo-linha-editorial/publicacoes-institucionais/avaliacoes-e-exames-da-educacao-basica/relatorio-pedagogico-enem-2013-2011-2012

Krasilchik, M. (1988). Ensino de ciências e a formação do cidadão. *Em Aberto*, *7*(40), 55–60. http://emaberto.inep.gov.br/ojs3/index.php/emaberto/article/view/2044

Maia, P. F., & Justi, R. (2008). Desenvolvimento de habilidades no ensino de ciências e o processo de avaliação: análise da coerência. *Ciência & Educação (Bauru)*, *14*(3), 431–450. https://doi.org/10.1590/S1516-73132008000300005

Melchior, F. S. (2012). *Competências e habilidades linguísticas requeridas em instrumentos avaliativos em larga escala para ingresso no ensino superior* [Dissertação de Mestrado]. Universidade Federal de Goiás, Goiânia, Goiás.

Ministério da Educação (MEC). (2002a). *Parâmetros curriculares nacionais: Ensino Médio*. MEC/SEMTEC. http://portal.mec.gov.br/seb/arquivos/pdf/ciencian.pdf

Ministério da Educação (MEC). (2002b). *PCN+ Ensino Médio: Orientações Educacionais Complementares aos Parâmetros Curriculares Nacionais. Ciências Da Natureza, Matemática e Suas Tecnologias*. MEC/SEMTEC. http://portal.mec.gov.br/seb/arquivos/pdf/CienciasNatureza.pdf

Ministério da Educação (MEC). (2002c). *Exame Nacional do Ensino Médio-ENEM: Documento Básico*. MEC/SEMTEC. https://www.gov.br/inep/pt-br/centrais-de-conteudo/acervo-linha-editorial/publicacoes-institucionais/avaliacoes-e-exames-da-educacao-basica/enem-2013-documento-basico

Ministério da Educação (MEC). (n.d). *Matriz de Referência ENEM*. MEC/INEP. https://download.inep.gov.br/download/enem/matriz_referencia.pdf

Norris, S. P., & Phillips, L. M. (2003). How literacy in its fundamental sense is central to scientific literacy. *Science education*, *87*(2), 224–240. https://doi.org/10.1002/sce.10066

Organization for Economic Co-Operation and Development (OECD). (2018). *The future of education and skills: Education 2030*. Education Working Papers. https://www.oecd.org/education/2030/E2030%20Position%20Paper%20(05.04.2018).pdf

Perrenoud, P. (1999). *Construir as competências desde a escola. translated by Bruno Charles Magne*. Artmed.

Santos, J. S. D., & Cortelazzo, Â. L. (2013). Os conteúdos de biologia celular no Exame Nacional do Ensino Médio-ENEM. *Avaliação: Revista da Avaliação da Educação Superior (Campinas)*, *18*(3), 591–612. https://doi.org/10.1590/S1414-40772013000300005

Santos, R. A. (2015, August 25–28). *Os PCN como política unificadora de um currículo nacional: impasses e desafios na trajetória da implementação de um documento-base para a educação formal no Brasil*. VIII Jornadas Internacionais de Políticas públicas, São Luís, Maranhão. http://www.joinpp.ufma.br/jornadas/joinpp2015/pdfs/eixo13/os-pcn-como-politica-unificadora-de-um-curriculo-nacional-impasses-e-desafios-na-trajetoria-da-implementacao-de-um-documento-base-para-a.pdf

Sapatini, J. R. (2014). *Categorização e Análise das Questões de Biologia do ENEM (1998–2012)* (Trabalho de Conclusão de Curso, Universidade Tecnológica Federal do Paraná, Medianeira, Paraná). Repositório Institucional da Universidade Tecnológica Federal do Paraná (RIUT). http://repositorio.utfpr.edu.br/jspui/handle/1/21682

Silva, D. da, Rebelo, M. da P. S. S. P. V., & Canhoto, C. M. M. M. L. (2020). Percepções dos professores de biologia sobre a avaliação em larga escala em Portugal e Brasil. *Educação*, *45*(1), e139560, 1–36. https://doi.org/10.5902/1984644439560

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Compliance with Ethical Standards

The authors declare this study was conducted following ethical principles.