EXPLORANDO EL HUECO ENTRE EL CURRÍCULO PRETENDIDO Y EL IMPLEMENTADO: PERCEPCIONES DE DOCENTES EN FORMACIÓN Y EN ACTIVO

Exploring the gap between intended and enacted curriculum: perceptions of future and in-service teachers

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Abstract

The arrival of new curricula has reignited questions such as 'Why should mathematics be learnt in school?' and 'What kind of mathematics should be learnt?'. Although the answers are similar to those traceable in curricula from much older laws, not necessarily explicitly competence-based, the new curricula incorporate significant innovations. However, as pointed out by other authors with whom we agree, the change in teaching practice is not yet fully realised. In this seminar, we explain the process of creating these curricula in Spain, with a specific focus on Aragon, whose design is inspired by other international curricula. We also examine the associated teacher training. Subsequently, we present some results that illustrate the reflections of future teachers upon reading this new curriculum and how they compare with the concerns of in-service teachers.

Keywords*: mathematics education, classroom culture, curriculum, teacher training.*

Resumen

La llegada de los nuevos currículos ha vuelto a poner sobre la mesa cuestiones como ¿para qué hay que aprender matemáticas en la escuela? o ¿qué matemáticas hay que aprender? Aunque las respuestas son similares a las que se pueden rastrear en currículos de leyes muy anteriores, no necesariamente competenciales de forma explícita, los nuevos currículos incorporan importantes novedades. Ahora bien, tal y como señalan otros autores con los que coincidimos, el cambio en la práctica docente no termina de producirse. En este seminario exponemos cómo ha sido el proceso de elaboración de estos currículos en España y el caso particular de Aragón, cuyo diseño se inspira en el de otros currículos internacionales. Además, analizamos cómo ha sido la formación al respecto. A continuación, presentamos algunos resultados que ilustran las reflexiones de futuros maestros al leer este nuevo currículo y cómo se comparan con las inquietudes de docentes en ejercicio.

Palabras clave*: educación matemática, cultura de aula, currículo, formación de profesorado.*

INTRODUCTION

The mathematics curriculum holds significant importance in the field of Mathematics Education research. This importance is evidenced by its presence in academic Handbooks such as those by Bishop et al. (1996) and Clements et al. (2013), as well as the recent specialised publication (Shimizu & Vithal, 2023) emerging from the 24th ICMI Study Conference School Mathematics Curriculum Reforms. Moreover, at international conferences like ICME or CERME, the existence of dedicated workgroups focusing on the research and development of mathematics curriculum and curriculum resources is a common feature. Whilst there is no standalone entry titled "Curriculum" in the Encyclopedia of Mathematics Education (Lerman, 2020), explicit references can be found within ten of its entries, both in their titles and in their associated keywords.

The recent curricular reform in Spain has once again foregrounded research into aspects of curriculum implementation, the objectives of education, and how focusing on these objectives necessitates a

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competence-based approach. While not the first "competence-based" curriculum, the new regulation introduces significant innovations concerning curricular organisers and represents "the first significant change of the 21st century in the Spanish educational field" (Contreras, 2022, p. 64). Motivated by this challenge, the topic was addressed at the 2022 SEIEM symposium held in Santiago, with a seminar entitled "The development of the new curricular framework in mathematics", coordinated by Antonio Moreno (2022) and featuring presentations from Ana Paula Canavarro, Luis Carlos Contreras and José Manuel Diego-Mantecón. It is worth noting that this interest is not at all new to our society, as curricular documents and regulations also had explicit representation in various presentations at previous symposium seminars, such as in De Castro (2016) or Puig (2008).

The concept of curriculum has evolved, now encapsulating more than just a syllabus or list of teaching topics. Today, it encompasses textbooks, instructional methods, the pedagogical philosophy informing teaching materials and practices, teacher training, and assessment guidelines (Osta, 2020). Research, as a result, offers varied theoretical curriculum models. One frequently used in maths education posits three levels: intended (system level), implemented (class level), and attained (student level) curricula (Valverde et al., 2002). Some, like Osta (2020, pp. 576-577), include an "assessed curriculum", referring to content and processes assessed in tests.

Remillard and Heck (2014) reflect upon the curriculum enactment process across different cultures and educational realities, refining the model from Valverde et al. (2002). They incorporate the aforementioned assessment aspects and distinguish between different instructional materials of the intended curriculum. These authors distinguish at the first level the *official curriculum*, involving the educational administration, and the *operational curriculum*, involving the teacher and students. In the official curriculum, they identify three elements:

- *Curricular aims and objectives*: these are the specified learning expectations and outcomes often set or adopted by the administration, which may include, for instance, the content, specific competencies, or various learning standards present in ministerial orders.
- *Curricular content of consequential assessments*: this refers to the content of official evaluations that have consequences for students, teachers, or schools. In the Spanish system, this would be determined by external tests, such as the University Entrance Examination (*Prueba de Acceso a la Universidad*, PAU).
- *Designated curriculum*: this is the set of instructional plans specified by an authorised governing body. It is generally informed by the official curricular aims and objectives and is intended to offer guidance towards addressing these goals. It provides a level of instructional specificity that curricular objectives and assessment items do not. This can also include certain "instructional materials" that are developed or endorsed by the administration. In the Spanish case, the instructions and recommendations for the development of course planning documents (an official document called "programación didáctica") provided by the educational inspection service, as well as repositories with different learning situations, can serve as clear examples of this.

These three elements, along with others such as instructional materials that may be external to the educational administration (e.g., commercial textbooks), directly influence the operational curriculum, specifically the interpretations and decisions teachers make in order to envision and plan instruction (*teacher-intended curriculum*), the interactions between teachers and students around the tasks of each lesson and accumulated lessons in a unit of instruction (*enacted curriculum*), and ultimately, the learning achieved by the students (*student outcomes*).

Thus, as reflected in these models, teachers emerge as key agents in the implementation of these levels of the curriculum, being responsible for interpreting and transforming the official curriculum into an operational curriculum, proposing and managing different instructional tasks in the classroom.

Llinares et al. (2020) note that the gap between the official and operational curriculum, regardless of the level of detail and prescription of the curriculum description, markedly affects the relationship between teachers and curricula, as the curriculum implemented by teachers in their teaching practice always tends to be a gradual composition of the old and the new. In this regard, we can assert that knowledge of the curriculum and mastery of the professional competencies required for its articulation are essential, as pointed out by various models of teacher knowledge and skills, such as the Didactic-Mathematical Knowledge and Competence model (DMKC) (Godino et al., 2017).

Contreras (2022) compares the objectives and elements of the new national curriculum with those of the 90s LOGSE Basic Curricular Development, concluding that the changes are heading in the right direction. However, he emphasises the need for teachers to embrace curriculum principles and for initial training to align with derived professional competences. Canavarro (2022) pinpoints critical issues for new curricula development, such as teachers adapting to a curriculum challenging dominant teaching conceptions and educational administrations' commitment to curriculum development and teacher collaboration. Similarly, Diego-Mantecón et al. (2022) underline the need for collaborative working groups among different discipline teachers to effectively integrate STEM subjects as proposed in new curricular guidelines.

Over the last two academic years, the authors have actively participated in Aragon in the construction of the official curriculum and in the implementation processes of the new regulations. In this paper, we try to answer some of the questions posed by the seminar coordinator. For this, we briefly address in the first section the process of drafting the official curriculum, considering the three elements pointed out by Remilliard and Heck (2014). Secondly, we indicate some measures directed towards teachers and their training that have been carried out by educational administrations, societies, or teachers' groups for the development of the new curriculum in Aragon and the rest of Spain. Thirdly, we try to identify and analyse different perceptions and concerns of teachers in training and in practice regarding the new curricular regulations through the analysis of the productions and reflections of teachers in training who make an active reading of the curriculum and the questions asked by in-service Aragonese teachers addressed to the educational administration about the new regulations. We conclude by suggesting some actions that we consider fundamental for curriculum development.

THE PROCESS OF DEVELOPING THE OFFICIAL CURRICULUM

The development of the national curriculum and the analysis of the new national framework, its objectives, and its elements were already the subjects of the presentations at the previous seminar (Canavarro, 2022; Contreras, 2022). In this paper, we will describe the process of developing the curricular document in the Autonomous Community of Aragon, where elements distinct from those of the official curriculum, specific to the designated curriculum, have been developed. For example, the clarification around learning situations and teaching guidelines. Subsequently, we explore elements inherent to the *curricular content of consequential assessments* through a review of the tasks from the pilot tests of the PAU.

The curricular development process in the Autonomous Communities

In Spain, Autonomous Communities have the authority to develop their curricula based on the national framework. In this sense, regional governments can make decisions to complete, specify, or reorganise the national curriculum and introduce methodological guidelines. We present the case of the Autonomous Community of Aragon, in whose development the authors have been involved at various levels of the process.

In the initial phase, the national curriculum (MEFP, 2022a, 2022b), the document prepared by CEMAT (2021), and different international curricula were reviewed, particularly the Portuguese curriculum (Canavarro, 2022). To facilitate the implementation of a curriculum with greater technical complexity, Aragon opted for a curricular architecture that would bring the normative document

closer to the reality of practising teachers. In this way, while maintaining the prescriptive curricular elements of the national regulations, the attempt was made to clarify and expand the explanations about these, provide more information on the evolution of assessment criteria throughout the stages, introduce practical guidelines for working in the classroom with the core contents, introduce didactic and formative assessment guidelines, and specify the design of learning situations, providing real examples of situations that mobilise the specific competencies experienced in the classroom. All of the above is supported by references to research in mathematics education that could assist teachers in delving deeper into the issues raised in the curriculum.

Thus, in the first instance, a curricular document was proposed that presented an original architecture and incorporated new curricular elements. The curricular documents of the area of mathematics for Primary Education, Compulsory Secondary Education (ESO, in the Spanish acronym) and Baccalaureate (DECD, 2022) are structured as shown in Table 1:

Table 1. Structure of the Aragonese Curriculum Document

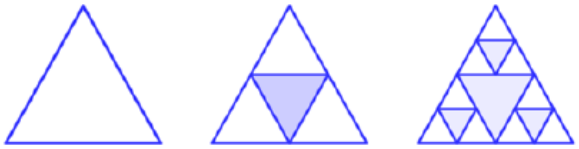
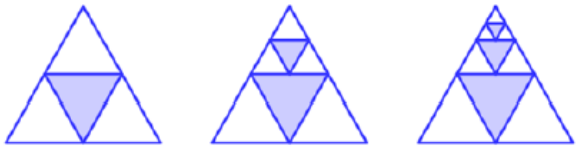
Document section	Description
Introduction	An introductory section that includes, for example, the purposes of mathematics education and other general aspects.
I. Specific competencies	Each competency is detailed, linked with other specific competencies, and aligned with the student profile upon completion of compulsory education.
II. Assessment criteria	Explicit links are carefully established with the specific competencies and clarifications are introduced on the evolution of the criteria throughout the stage, especially in primary education.
III. Core contents	In the first part, a detailed description of each of the senses that structure the core contents is carried out. In the second part, the tables of core contents are introduced by cycle/course, distinguishing for each of the sub-blocks a column with the contents (knowledge, skills and attitudes) and another with "Guidelines for Teaching".
IV. Recommended methodological approaches	This section is structured from greater to lesser complexity in subsections: 4.1 General didactic and methodological suggestions for the teaching of mathematics. 4.2 Assessment of learning, with special attention to the formative character of assessment, adding suggestions on how to effectively implement this approach. 4.3 Design of learning situations. The subsection addresses the general characteristics of the design of learning situations within the discipline. 4.4 Examples of learning situations. The design and implementation of different learning situations are exemplified, which have been extracted from the literature in mathematics education research or have been developed and experimented by the people who made up the working groups.

The "Guidelines for Teaching" column within the Core Contents section includes (see Figure 1): internal connections between blocks of the subject, more detailed descriptions of the contents of the different blocks, types of activities within each block of senses, justifications for possible timetables by course, connections with other subjects, concretization, explanation and exemplification of the items contained in the core contents, types of tasks that can be proposed for different core contents, materials and resources specifically associated with certain core contents, etc. This characteristic of the Aragonese curriculum, clearly inspired by the Portuguese curriculum (Canavarro, 2022), is one of the features that distinguish it from other regional curriculum developments and represents one of its main strengths. It is worth noting that although the Early Childhood Education stage does not have a specific area or subject of mathematics, the curriculum development also followed a similar structure (DECD, 2022).

To be able to develop such an ambitious document as the described one within the limited time available in the autonomous community, mixed working groups were set up that combined practicing teachers with extensive experience and recognized prestige (experts in mathematics education, active members recommended by mathematics teachers' societies, etc.) and university teachers from the

area of Mathematics Education at the University of Zaragoza. For the mathematics subjects, these mixed groups developed high-quality, specific guidelines, accessible to teachers and based on updated scientific literature.

Figure 1. Excerpt from a table of core contents with the column "guidelines for teaching" (DECD, 2022)

<table>
<tr><th colspan="2">A. Sentido numérico</th></tr>
<tr><td colspan="2">El sentido numérico acompaña siempre, en los quehaceres diarios y en la vida académica. En este curso se realiza una síntesis de todo lo trabajado durante la primera etapa de la secundaria. Aparecerán nuevas tareas, pero los procedimientos son similares. Por tanto, los razonamientos se esperan más maduros y críticos. El alumnado debe ser capaz de expresarse matemáticamente con la terminología adecuada tanto para escribir las secuencias del cálculo como para expresar sus razonamientos y conclusiones de forma verbal.</td></tr>
<tr><th>Conocimientos, destrezas y actitudes</th><th>Orientaciones para la enseñanza</th></tr>
<tr><td>A.2. Cantidad:
- Números grandes y pequeños: notación exponencial y científica y uso de la calculadora.
- Realización de estimaciones con la precisión requerida.
[...]</td><td>En lo que se refiere al manejo de las cantidades, estimaciones y uso de los diferentes sistemas numéricos, no hay mucha variación respecto de los dos primeros cursos de la ESO.
En este curso, cuando estudian los conjuntos numéricos, además de la relación de contenido entre ellos, se debe reflexionar acerca de qué acciones se relacionan con cada campo numérico (Calvo et al., 2016): contar (N), situar (Z, Q, R), expresar variaciones (Z, Q), expresar partes o razones (Q), medir (Q, R), ordenar (N, Z), codificar (N).
[...]</td></tr>
<tr><td>[...]</td><td>[...]</td></tr>
<tr><td>A.4. Relaciones:
- Selección de la representación adecuada para una misma cantidad en cada situación o problema.
- Patrones y regularidades numéricas.</td><td>Una posible actividad a realizar en este bloque sería la siguiente: En cada una de las dos series, los triángulos se obtienen uniendo los puntos medios de los lados. Calcula el área de los triángulos sombreados, así como de los triángulos que ocupen los lugares 4, 10 y 15 de la serie (Gairín y Sancho, 2002):
Serie 1:
 
Serie 2:
  </td></tr>
</table>

In addition to the ESO subjects defined in the national regulations, it should be noted that the curricular development team fully designed the optional 4th ESO subject, *Mathematics for Decision Making*, which is articulated around knowledge related to modular arithmetic and cryptography, graph theory, and game theory and collaborated in the design of the *Key Competence Reinforcement Laboratory* subject for 1st and 2nd ESO.

Curricular content of consequential assessments: the pilot tests of the PAU

The PAU, conducted at the end of the second year of Baccalaureate, are the external assessment tests that most influence the teaching and learning processes of mathematics in Baccalaureate, particularly in that final year (Contreras et al., 2010; Rodríguez-Muñiz et al., 2016). Currently, the Ministry of Education, through the National Institute of Educational Evaluation, is working on the design of a new PAU that adheres to the competency learning of the new curriculums through various working groups. To this end, during this school year, new tests have been carried out as a pilot, where the statements of the tasks and the assessment rubrics have been released (https://bit.ly/3oOwu5H).

The pilot test's conditions differ from the current ones, extending the completion time from 90 to 105 minutes and allowing graphic calculators. Unlike the current PAU, the test proposes thematic evaluation units comprising various student tasks. It particularly emphasises competencies like modelling, representation, and extramathematical connections. Conversely, competencies like conjecture formulation, reasoning, and communication processes aren't as prominent. Moreover, the test's nature does not address collaborative work, and restrictions on dynamic geometry systems limit the evaluation of some key curriculum competencies.

Societies, such as the RSME (https://bit.ly/3OPlYWn) or the CRUE (https://bit.ly/3OSjKFQ), have pointed out potentialities and limitations of these tests. However, it is worth noting that this attempt

at alignment between the PAU and the Baccalaureate curriculum is not free from difficulties and tensions due to the social function of these tests in which the responsibility of organisation corresponds to the universities.

INITIAL AND CONTINUOUS TRAINING AROUND THE NEW CURRICULA IN SPAIN AND IN ARAGON

As we have seen, these new curriculums pose a challenge. Thus, with the arrival of these new curriculums, it would be desirable to have initial training structures and professional development programs that integrate theory and practice in line with Coles et al. (2023). Administrations and associations at both the national and regional level have proposed training or dissemination initiatives for the new framework.

Various training initiatives were carried out in the past academic year. Nationally, the INTEF (National Institute of Educational Technologies and Teacher Training) organised generalist courses and conferences, including "From curriculum to classroom practice", "Learning situations for the development of competencies", "Assessment of competencies through performance" and "National conferences on the curricular, competency-based and inclusive model". Specific to mathematics, courses like CEMAT's "Foundations for a mathematics curriculum in non-university education" were developed. Notable contributions include a book titled "Contributions to the development of the curriculum from research in mathematics education" by the SEIEM and seminars by the FESPM (Spanish Federation of Mathematics Teachers' Societies), such as: "Mathematical senses in the new non-university curriculums" and "Learning situations in the mathematics classroom".

During the 2022-2023 academic year, a "pyramidal" training programme was developed in Aragon, focusing on new curricula. Primarily providing generalist training, it differentiated mostly by educational stages, with a few exceptions targeting specific knowledge areas or subjects. It began within a small administrative group, later extended to the educational inspection service, and then to management and educational guidance services. The training, covering the new regulatory framework, curriculum organisers, competency-based assessment, learning situations, and teaching programming design, also included teaching advisors from the Teacher Centres (CP, in Spanish acronym).

From that moment on, the CPs organized generalist courses on new curricula in their area of action where teachers could register voluntarily. These courses (between 10 and 12 hours of training) replicated the initial structure incorporating sessions on curriculum regulation, competency-based assessment, design of course planning and learning situations. Again, this training mostly overlooked the specificity of each subject or area of knowledge, even more so if we consider the differences that are generated between subjects with the incorporation of the new curriculum elements, especially with the incorporation of the specific competencies of each subject. For example, only one of the CPs organized the session on learning situations differentiated by specialities.

Aside from this institutional program, some individual initiatives from some CP advisors, mathematics education research groups, groups of private teachers from a centre, the Aragonese Society of Mathematics Teachers, or private entities, have promoted the implementation of continuous training courses related to the new curriculum, but focused on mathematics. Notable courses include "LOMLOE Mathematics", "Mathematics for Decision Making" organized by teacher centres, individual initiatives such as those of Educaixa HelloMath! Program (https://bit.ly/3P76P3d) and attempts to create communities and groups of teachers who collaborate for their professional development (Llinares et al., 2020) from various projects based on the development of Lesson Studies (Martínez-Juste, 2020) or the use of social networks such as Twitter or Telegram. Additionally, it is worth noting that, as has probably happened in other autonomous mathematics teachers' conferences, the program of the V JEMA (Mathematics Education Conference in Aragon) has been marked by lectures, courses and workshops related to the implementation of the new mathematics curriculum.

However, in addition to these specific training activities, it would be interesting to have a stable and ambitious ongoing training plan from the Spanish scientific societies, similar to the one outlined by Mellone et al. (2023).

PERCEPTIONS OF TEACHERS IN INITIAL TRAINING AND IN PRACTICE ABOUT THE NEW CURRICULA

An interesting issue that arises in the context of implementing a new curriculum regulation is to explore the challenges faced by both pre-service and in-service teachers. Once these challenges are identified, it will be possible to design and implement training processes that address the demands of bringing these curriculums to the classroom. With this objective, in this section we present some results of two experiences that illustrate the different perceptions of pre-service teachers and in-service teachers about the regulations.

An experience with future teachers

The study plans comprising the initial training of teachers include, in one way or another, an understanding of the curriculum. In this way, future teachers must not only know the current curriculum that will govern their professional practice but also develop the necessary skills to interpret it and connect it with the rest of the didactic-mathematical content they acquire throughout their training. In this time of curricular change, it is particularly interesting to gain an understanding of how future teachers approach the reading of curricular documents (Drake et al., 2014; Wilson, et al. 2010). What do they focus on? What catches their attention? Do they relate their reading of the curriculum to their experience as students within the educational system? Do they relate it to what they learn in their university training as future teachers?

To answer these questions, we have designed a training device that is framed within the subject Didactics of Geometry, in the third year of the degree in Primary Education Teaching at the Faculty of Education in Zaragoza. Additionally, this is the last compulsory didactic mathematics subject of the degree, so at the time the device is implemented these students have a complete view of the area (within the framework of initial training).

The experience, in which 57 students participated, consisted of the “active reading” of the new Mathematics curriculum for Primary Education developed in Aragon. This reading was carried out through the online platform Perusall, which offers an environment that invites users to make shared highlights and annotations in the document. These annotations sometimes lead to interactions between users, as they can ask questions, answer them, and rate comments. In addition, the platform keeps a record of the time each participant spends on each page and calculates metrics of the quality of comments and interactions. These metrics, set by the course teacher, consider various factors such as interaction time, comments, words, received responses and votes, and full document reading. The default configuration in the training device led to an average score of 2.75 out of 3. Most participants (73.3%) achieved full marks, while 23.3% completed the task without full marks, and only 3.3% didn't interact. Participants made 1321 comments and asked 123 questions, with 53 remaining unanswered. On average, it took about one hour and 56 minutes to complete the task.

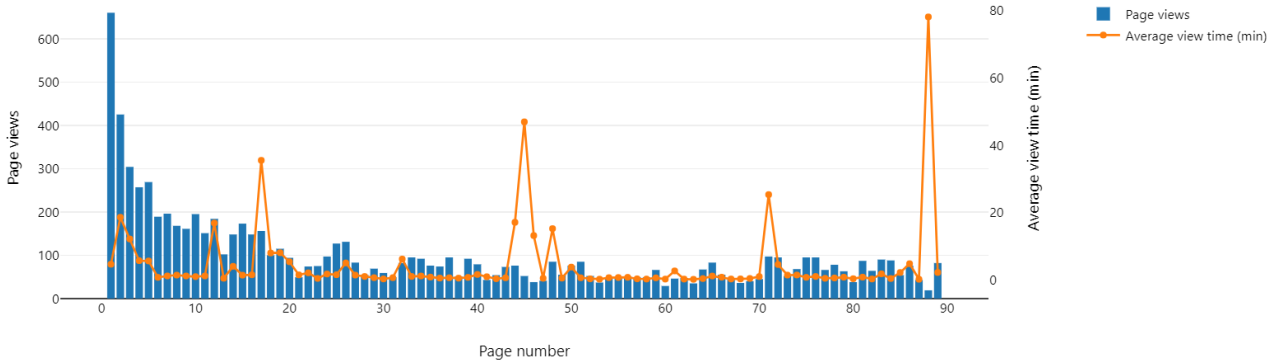
The instructions for the activity were as follows (this statement and students’ productions have been translated to English by the authors):

> This last homework counts double. It involves actively reading the document corresponding to the new Mathematics curriculum of Aragon through Perusall. Paying special attention to everything related to geometry, of course, but don't just stick to that.
>
> Perusall is a social network where interactions are valued with its measurement system. It will invite you to underline, comment, pose doubts, and answer those of other classmates (this is the sui generis definition of active reading in this case). Greater relevant participation, greater score.

If you need to take a look at any definition or article from the regulatory part (key competences, specific competences, learning situations, etc.), here it is in pdf and docx format. All the curriculum development is here: https://educa.aragon.es/en/-/normativa-primaria

Figure 2 shows the number of views per page of the document and the average time spent reading each of them. Leaving aside the issue that there are probably outliers for the average time (perhaps by leaving the browser window open), the trend is that there is a significantly higher number of views on the first pages of the document, decreasing until stabilizing around 50-100 views from page 20 onwards. Let us note that page 20 begins the section dedicated to basic knowledge, while the initial pages revolve around the preamble, specific competences, and assessment criteria.

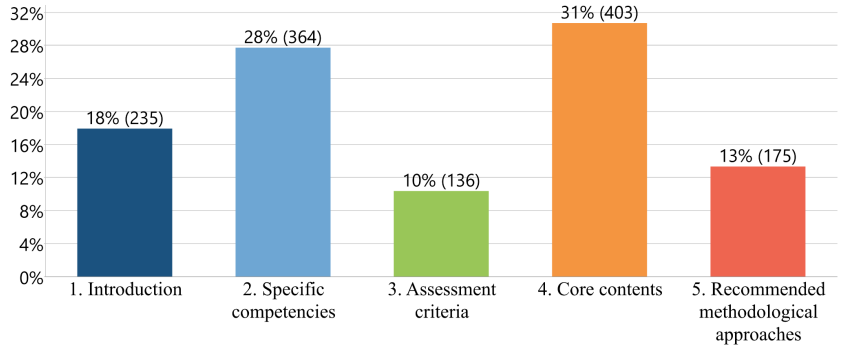
Figure 2. The number of views and time spent reading each page.



A total of 1313 interactions were collected, of which 1190 were catalogued by the platform as comments and 123 as questions. It is worth noting that the application separated the participants into four groups (default option), so that each interaction group was made up of about 15 students. Among the comments, annotations about something believed to be important, such as mathematics or certain teaching methodology, reflections that relate what was experienced in the degree subjects with what is developed in the curriculum, and annotations and value judgments based on their experience as Primary and Secondary students are distinguished. As for the questions, some are aimed at clarifying what a certain concept that is not clear is and others at seeking the opinion of the rest of the group. For the analysis of these interactions, a qualitative methodology of content analysis has been followed, following an inductive-deductive coding scheme (Braun & Clarke, 2021).

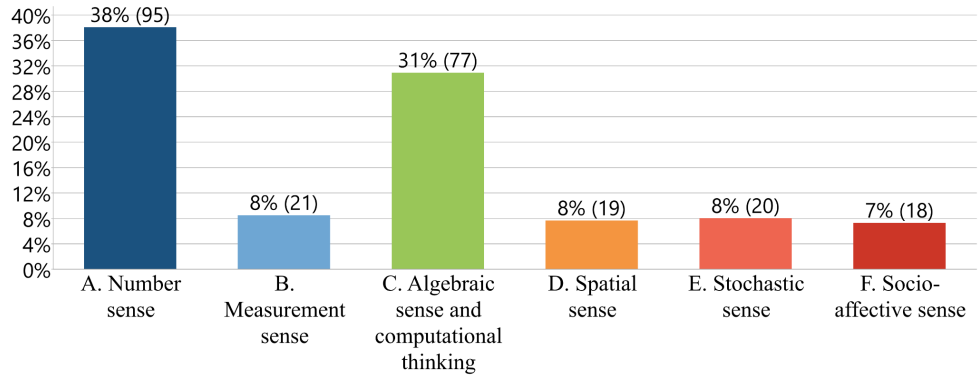
In the first place, the section of the document in which they made the underlining and annotations was coded. It is observed that, even though the introduction receives attention with comments and annotations, in line with the time dedicated to its reading (Figure 3), students training to be teachers are much more interested in the part of knowledge, followed by the specific competences. It is worth mentioning that the recommendations of Figure 3 refer to the final section of recommendations (they are not the Guidelines for teaching within the Core Contents).

Figure 3. Number of annotations made by future teachers in each section of the curriculum.



As for the Core Contents, we observe two clear results. On the one hand, the fact that, when they make annotations in the Core Contents section, these are mainly concentrated on the column of Guidelines for teaching (14% versus 86%). On the other hand, even though the task invites to focus on aspects of geometry (typical of the subject), we find many comments that address other types of core contents (reading beyond what is asked in the task of the subject arouses interest). Now, the senses that receive the most comments are the numerical sense and spatial sense (Figure 4). We dare to suggest that this distribution of the number of annotations is due to the importance they attach to the different core contents in the learning of Primary Education students.

Figure 4. Distribution of annotations in the Core Contents section.



In this way, the participants had taken Didactics of Arithmetic II during the previous semester. This subject revolves around the didactics of rational number and the processes of continuous magnitudes measurement are greatly worked on. However, the sense of measure receives very few annotations and underlines, being at the same level as algebraic sense and computational thinking, stochastic sense, and socio-affective sense.

Regarding the final section of Recommendations, which should not be confused with the column "Guidelines for teaching" of the section dedicated to the core contents, an uneven attention is also noted for each of the subsections. In this way, half of the 175 annotations of the participants refer to the subsection "5.1. Didactic and methodological suggestions" (50%), followed by "5.4. Learning situation examples" (26%). "5.2. Assessment" receives 17% of the annotations and "5.3. Learning situations design" the other 7%.

The underlining and annotations made during the active reading activity denote that this experience promotes reflection on the training received in the Degree in Primary Education Teaching. For example, in the sense of the measure we observe that there are students who connect with what was learned in Didactics of Arithmetic II:

> This concept must be clear in the teaching-learning process of Mathematics in Primary Education. The sense of measurement begins with the observation, comparison, analysis, and understanding of the objects that surround us. We have worked on this concept during the Didactics of Arithmetic II course and, thanks to the use of tangible material, students can better understand this term.

Other comments relate the experience lived in Primary or Secondary Education with the experience lived as students in the Teaching subjects. Thus, we find reflections like the following, which point out a common theme: the mistreatment of geometry in the enacted curriculum, which comes to illustrate some of the difficulties they have in the subject Didactics of Geometry, where their content knowledge is the source of difficulties:

> Guys, the same thing happened to me, I don't have much memory of having studied geometry in class. I suppose the reason is what you all are saying. This has also made the current course at the university, the didactics of geometry, difficult for me. I guess it has happened to all of us. In the didactics of arithmetic, I didn't have as many problems.

We also identify reflections that connect elements of the new curricula, such as learning situations, with what was learned in the subjects of the area: “Often when reading these lines, we struggle to understand their application. However, the development of the 'Didactics of Geometry' course clearly exemplifies the application of all these learning situations”.

In addition to the novelties in terms of curricular architecture, the new curricula incorporate novelty content, such as computational thinking. This is something that catches the attention of the participants, some of whom did not relate it a priori as something proper to the subject of Mathematics: “This concept seems very curious and interesting to me within the field of Mathematics”. However, other participants acknowledge having worked on the processes of computational thinking in the ongoing subject (Didactics of Geometry): “We have carried out the recognition of certain patterns in class where we have formulated our conjectures and learned about some theorems (Pick, Euler...)”

This comment is illustrative of the threads that are generated from interactions with other participants. Thus, another one replies: “That’s right, moreover we have done it recognizing patterns and establishing regularities without having any idea about the theorem we were facing.” And, finally, another participant agrees with his classmates, although he indicates that he is not entirely clear about what exactly computational thinking is:

> I believe so, I agree with you, as I deduce that when working in this area, the conjecture with primary school students is mainly focused on problem-solving through logic, which is essentially the definition (in a brief and clear way) of computational thinking (I think).

Outside of this thread, there is also some confusion regarding what computational thinking entails and what processes it involves in the Mathematics classroom: “It should be noted that the process of problem-solving in mathematics and the computational resolution process have certain similarities. What steps does each process have?”.

The emergence of a socio-affective competency axis, as well as a sense, also catches the attention of the participants, who recognise its importance in teaching and learning processes: “Emotion management is important in the arithmetic field, as many students feel frustration and reject this subject without even managing their emotions to continue trying.”.

Frequently Asked Questions in Aragon

Following the trainings carried out in Aragon, the Directorate of Educational Inspection prepared a Frequently Asked Questions (FAQ) document titled “FAQs regarding the curriculum, assessment, promotion and qualification in the different educational stages” (updated on February 28, 2023) (Government of Aragon, 2022). This is a 30-page document available on the website of the Department of Education, Culture and Sports of the Government of Aragon and is structured in eight sections, as indicated in Table 2. These questions reflect the concerns and anxieties of teachers regarding the implementation of the new curriculum regulations. We have conducted a content analysis on this document, identifying several thematic focuses, which we present below and which condense the feelings of practicing teachers.

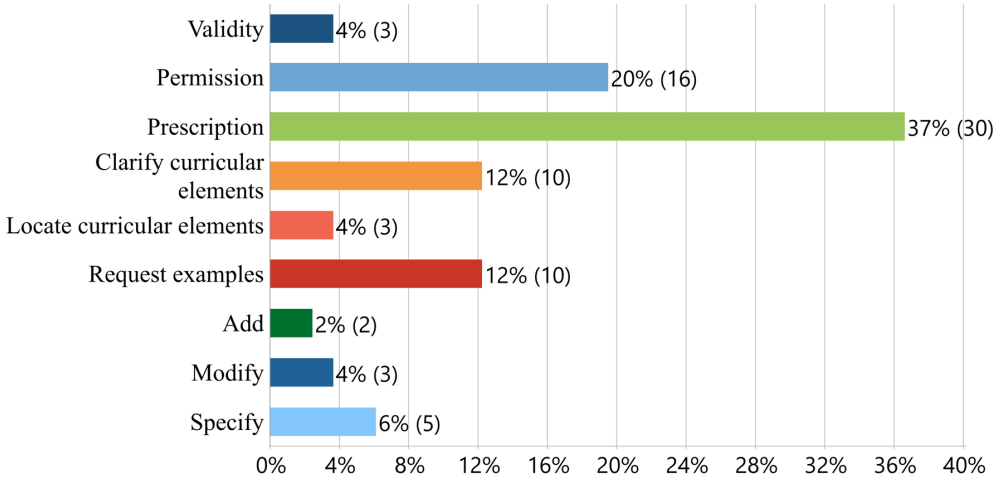
The initial section contains no questions, as it simply enumerates, by courses and stages, the current curriculum regulations. Otherwise, from the structure itself (Table 2), it is already clear that assessment and the development of the course planning document are some of the aspects of the regulations that generate the most doubts and concerns. In this sense, it is also worth noting that the seven pages dedicated to “Comparative Assessment Charts” mainly address technical issues such as promotion, permanence, qualification or simultaneity of studies. In addition, the document reserves a significant space for the Aragonese bilingualism model Brit-Aragon, which we will not consider in our study. However, we note that assessment and grading within this model is also a central element. The rest of the document includes 69 questions that we analyse in our study.

Table 2. Structure of the FAQ document from the Government of Aragon.

Section	Pages	Questions
Application of the current curriculum and evaluation regulations	2	0
General	6	PG1-PG34
Stage: Early Childhood Education	1	PEI1-PEI2
Stage: Primary Education	2	PEP1-PEP11
Stage: Compulsory Secondary Education	1	PESO1-PESO8
Stage: Baccalaureate	1	PBA1-PBA2
Brit-Aragon Model	4	PMBA1-PMBA17
Course planning document	5	PPD1-PPD12
Comparative Assessment Charts	7	0

First, what we observe is that the questions can be classified according to their purpose (Figure 5), even though some may address several of them. Thus, the majority of the issues express doubts about the compulsory nature of certain aspects of the regulations. For example: "Is it compulsory to program learning situations?" (PG4) or "Are the guidelines for teaching that appear in a column associated with core contents compulsory?" (PESO6). This illustrates a certain difficulty in interpreting the regulations, in particular, to discern the prescriptive wording from what is not. There are also many questions (20%) whose purpose is to ascertain whether permission or authority is given for certain actions, an example being "Can a learning situation cover different subjects?" (PG6) or "Can the wording of the assessment criteria be modified?" (PPD11). In particular, PPD11 and others are related to the difficulty, mentioned earlier, in discerning the prescriptiveness of the wording from other optional elements. PPD11 well illustrates the fact that some questions ask whether certain curricular elements can be added, modified, or specified.

Figure 5. Purposes of the questions in the FAQ document.



There is also a significant percentage of issues that request clarification of the meaning or implications of a curricular element, such as "What do I associate the grading criteria with?" (PG25) or "How is it checked whether the students have reached the key competencies given that at this stage they have no associated operational descriptors?" (PEI1). There is a particularly striking confusion regarding learning situations, as shown by the question "Is a learning situation the same as a teaching unit?" (PG2). In some cases, some questions express difficulties in locating curricular elements in the regulations: "Where are the specific competencies?" (PG10). Finally, 12% of the questions are essentially requests for models or examples, such as "Is there an official model for elaborating the course planning document in the Autonomous Community of Aragon?" (PPD2).

In analysing the focus of these questions, a 34% of queries concern curricular elements (key competences, exit profile, specific competencies, core contents, etc.). Given the substantial changes

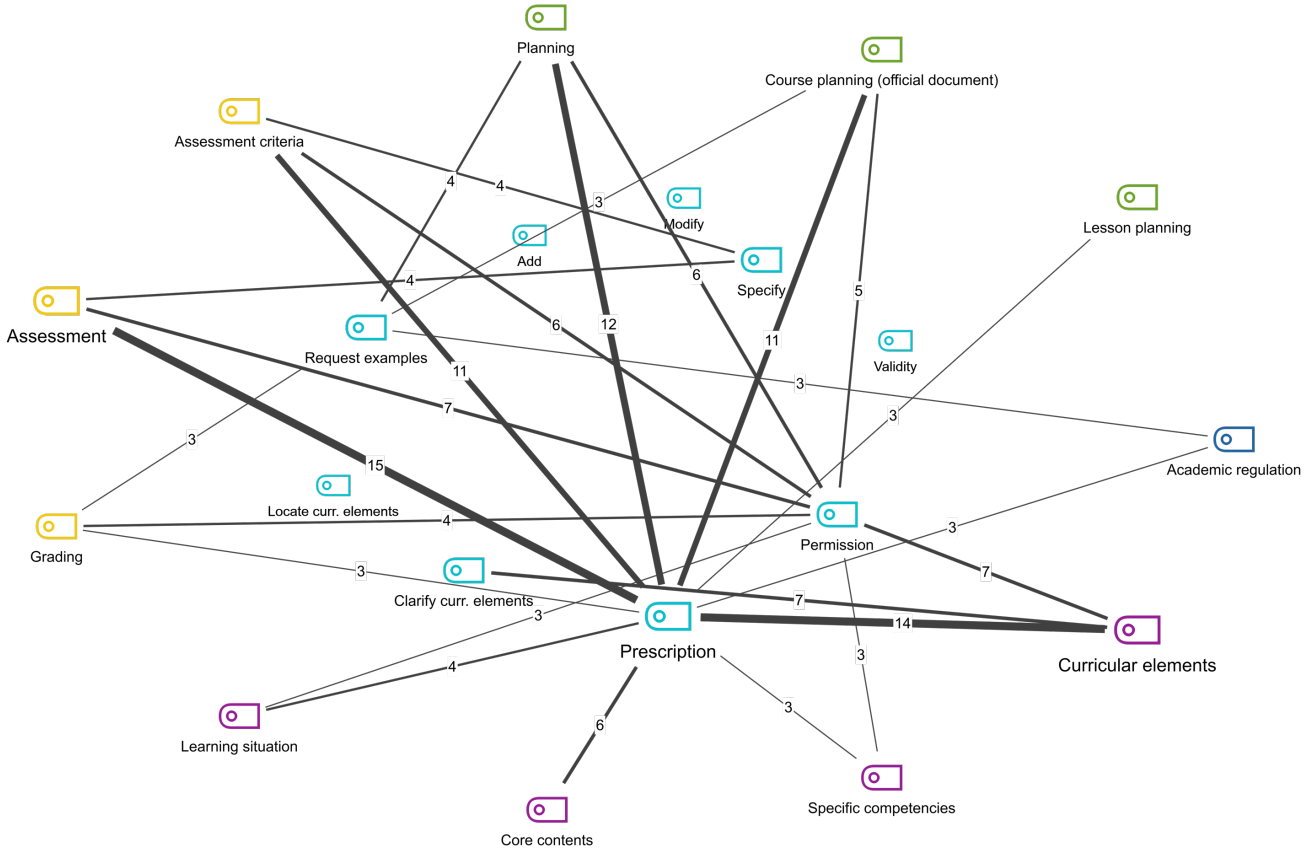
in the new curricula, such queries are understandable, for instance, "Are the assessment criteria associated with core contents?" (PG11).

Interestingly, 29% of FAQs tackle assessment-related topics (assessment criteria, assessment instruments, etc.), and an additional 8% explicitly discuss grading (grading criteria, weighting, etc.). Although grading is part of evaluation and assessment, we made a distinction during coding when grading was explicitly mentioned. For instance, "Can the assessment instruments related to the assessment criteria be weighted?" (PG13) was tagged as both assessment and grading, as it pertains to criteria (assessment) but also clearly concerns grading by asking about weighting. Conversely, "Can different weight be given to specific competences?" was coded as grading but not as assessment.

The high frequency of assessment and grading queries suggests that these are key concerns for practising teachers aiming to align with regulations. Authors like Ohlsen (2007) highlight the difficulty of changing classroom practices due to contentious grading demands and ingrained assessment practices. Questions also encompass academic organisation, including promotion, graduation conditions, planning, and interdisciplinary approaches.

To better interpret these FAQs, we can correlate the purpose and the object of the questions. Figure 7 displays the co-occurrence map of codes within each question, revealing high concern about prescriptive elements in assessment, particularly relating to assessment criteria. Uncertainty around prescriptiveness of curricular elements and course planning document preparation is also prevalent.

Figure 7. Co-occurrence map of codes (3 or more matches) in the FAQs.



CONCLUSIONS

The official curriculum represents a significant change from the previously implemented curriculum. On this occasion, educational administrations have tried to incorporate new elements into curricular purposes, the designated curriculum, and assessment to guide teaching practice in the classroom and to influence the processes of curriculum enactment (Remilliard & Heck, 2014).

Training plans from educational administrations, apart from exceptional initiatives, focus on general aspects of the new curricula. Given the difficulties observed in interpreting curricular elements in the experience with future teachers, as well as in the questions collected in the FAQ document, we believe that a greater presence of specific didactics in the Teacher and Master's Degree plans is necessary. Likewise, the ongoing training of practicing teachers should be framed within professional development plans, which are currently non-existent. The difficulties we have observed regarding the meaning of curricular elements coincide with what we have noticed in the trainings we have conducted. Not only that, but novelties such as computational thinking present challenges even in their definition (Weintrop et al. 2016). In any case, a future line of work should explore the perceptions of these specific innovations in mathematics with in-service teachers. The experience with future teachers has shown that, for example, the socio-affective competency axis, sparks interest and almost all the participants who made annotations agreed on its importance, even though its impact on the cognitive plane, as well as on the rest of the facets of the teaching and learning processes, was not clear (Beltrán-Pellicer & Godino, 2020).

Active reading of curricular materials is a rewarding task, facilitating engagement with curricular regulations. Specifically, the "Guidelines for teaching" column has sparked considerable interest among prospective teachers. These guidelines, while not prescriptive, form part of the designated curriculum (Remilliard & Heck, 2014), akin to curricular materials proposed by administrations in other international curricula such as Portugal or Ontario. Land et al. (2015) explored how pre-service elementary mathematics teachers engage with educative curriculum materials, marking an emerging research line in mathematics education. They concluded that these materials should incorporate uncommon design features. Hence, the inclusion of the guidelines column in the curriculum, alongside core contents, appears to promote thorough and formative reading.

As for teachers' perceptions, the analysis of the FAQs has revealed that one of the major concerns of practicing teachers facing the implementation of the new curricula has to do with prescriptiveness. This suggests that the official curriculum is not so much understood as an element that characterizes teaching practice, but as something merely administrative. The interest in the prescriptive elements of the curriculum in the FAQs, as well as the demand for specific guidelines and examples from the administration, highlight the tensions experienced by practising teachers regarding their autonomy in curriculum implementation. Flores (2005) and Hong and Youngs (2016) have identified these concerns in interviews with teachers facing new curricular changes across different educational cultures, where teachers may not welcome more curricular autonomy, as it requires them to make their own decisions on complex issues instead of following external guidelines. Besides, there is also concern about assessment and, in particular, grading. As we have already pointed out, this is consistent with observations from authors like Canavarro (2022) and Ohlsen (2007), who identify assessment as one of the key aspects of curricular change.

In any case, we cannot expect that curricular change alone will bring about a change in classroom practice (Gimeno, 1982; Stigler & Hiebert, 2009) unless it is through the promotion of ongoing and initial training activities so that teachers become part of this change and bring it to the classrooms (Llinares et al., 2020). We hope that this curriculum will mark a turning point and be the origin of an improvement in initial and ongoing training.

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