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Students' digital competence: Basque secondary school students' digital competence development through EKI educational resource

ITZIAR GARCIA BLAZQUEZ // Eskoriatza, 2021

STUDENTS' DIGITAL COMPETENCE: BASQUE SECONDARY SCHOOL STUDENTS' DIGITAL COMPETENCE DEVELOPMENT THROUGH EKI EDUCATIONAL RESOURCE

ITZIAR GARCIA BLAZQUEZ

Zuzendariak:
AINARA IMAZ AGUIRRE (Mondragon Unibertsitatea)
FRANCESC ESTEVE-MON (Universitat Jaume I)

Mondragon Unibertsitatean doktoregoa lortzeko egindako doktore-tesia

Humanitate eta Hezkuntza Zientzien Fakultatea (HUHEZI)
Mondragon Unibertsitatea
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Amamari,
zuri zor dizudalako
gaur egun naizena.

«[…] pentsamendua eta egintzak ez dagozkio soilik norbanakoari, ingurutik edaten dute, askoren artean lantzen den ekosistemaren parte dira.»

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Nire bizitzaren errepasoa egiterakoan, azken bost-sei urteetan bereziki; mugimendu handiko bost-sei urte izan dira. Korapiloz jositako soka da bizitza. Sokaren bi muturrak borobilean elkartzen saiatzen gara, zikloka biziz. Hasiera eta amaiera oro korapilatu egiten zaizkigu. Bada, korapilo horiek askatzea datsegit. Maite izan dudan jendea joaten ikusi dut, baina berriak jaio dira, eta nire mapa mundi humanoa berriro betez doa.

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ABSTRACT

Digital competence has become a vital component of education in the 21st century and, as such, students need to be trained to meet its demands. In the Basque region of Spain, a digital competence exit profile for secondary school students has been defined, which is intended to be used alongside a newly created educational resource called EKI. There is scarce research that takes into account an educational resource to deal with digital competence. The study is based on the premise that EKI educational resource is an innovative educational resource whereby secondary school students develop their digital competence, and that digital competence is considered a cross-curricular competence for secondary school students. The overall aim of the dissertation is to analyse whether the use of EKI educational resource is sufficient to achieve the digital competence exit profile defined for Basque secondary school students.

Firstly, it comprises a review of relevant research and theoretical foundation with regard to digital competence, focusing on the EKI educational resource for developing student digital competence in secondary education. Second, methodologically, the dissertation uses the exploratory design as research method with a descriptive approach to study the aspects of integration of digital competence in EKI educational resource. Secondary school students' digital competence was in this study operationalised through three theoretically interrelated concepts; educational resource subject-level, digital competence area and digital competence proficiency level. Thirdly, the main research question has been operationalized through four sub-questions and each of them have been explored through an individual sub-study.

The findings demonstrate the complex process to achieve the digital competence exit profile in secondary education using the EKI educational resource. Although all digital competence areas were identified through the activities, not all the areas are developed in the same way. In addition, while analysing the activities by school subject and digital competence area, results showed that some school subjects could facilitate the development of digital competences.

Keywords: digital competence, secondary school students, EKI educational resource, teaching material, secondary education

LABURPENA

Teknologiaren eta digitalizazioaren aro honetan, eskolaren erronka nagusienetako bat da konpetentzia digitalaren garapena; egungo ikasleek prestakuntza behar dute gizartearen premia/eskaera berrietara egokitzeko. Euskal Autonomi Erkidegoan, konpetentzia digitalaren irteera-profil bat zehaztu da Derrigorrezko Bigarren Hezkuntzako ikasleentzat, eta hori garatzeko, Ikastolen Elkarteak Eki izeneko hezkuntza baliabide berria sortu eta erabiltzen du. Gutxi dira konpetentzia digitala lantzeko hezkuntza-baliabidea kontuan hartu dituzten ikerketak. EKI hezkuntza -baliabidea berrikuntzaren perspektibatik aztertzea izan da ikerketaren abiapuntua, zehatzago, DBHko ikasleen konpetentzia digitala garatzeko tresna gisa. Beti ere, konpetentzia digitala zeharkako konpetentziatzat definituz. Tesiaren helburu orokorra bigarren hezkuntzako euskal ikasleentzat definitutako konpetentzia digitalaren irteera-profila lortzeko Eki hezkuntza-baliabidearen erabilera nahikoa den aztertzea da.

Ikerketaren helburua erdiesteko, konpetentzia digitalaren arloko ikerketen eta oinarri teoriko garrantzitsuen berrikuspena egin da, bigarren hezkuntzako ikasleen konpetentzia digitala garatzeko Eki hezkuntza-baliabidea oinarri hartuz. Bigarrenik, metodologikoki, tesian esplorazio-diseinua erabili da ikerketa-metodo gisa, ikuspegi deskribatzailetik, konpetentzia digitala Eki hezkuntza-baliabidean integratzen den aztertzeko. Derrigorrezko Bigarren Hezkuntzako ikasleen konpetentzia digitala teorikoki osagarri diren hiru kontzepturen bidez operatibizatu da azterlan honetan: irakasgaiaren mailako hezkuntza-baliabidea, konpetentzia digitalaren arloa eta konpetentzia digitalaren maila. Hirugarrenik, ikerketaren galdera nagusiari erantzuteko, lau azpi-galdera xehetu dira, eta galdera bakoitza banakako azpi-azterlan baten bidez ikertu da.

Eki hezkuntza-baliabidearen bidez konpetentzia digitalaren irteera-profil osoa betetzeko prozesu konplexua erakutsi dute emaitzek. Jardueren bidez konpetentzia digitaleko arlo guztiak identifikatu diren arren, arlo guztiak ez dira modu berean garatu. Gainera, jarduerak eskola-irakasgaiaren eta konpetentzia digitalaren arloaren arabera aztertzean, zaila izan da zehaztea zergatik errazten duten eskolako irakasgai batzuek konpetentzia digitalen garapena.

Hitz-gakoak: konpetentzia digitala, bigarren hezkuntzako ikasleak, EKI hezkuntza-baliabidea, irakaskuntza-materiala, bigarren hezkuntza

RESUMEN

La competencia digital se ha convertido en un componente vital de la educación en el siglo XXI y, como tal, los estudiantes necesitan ser formados para satisfacer sus demandas. En el País Vasco el Gobierno Vasco ha definido un perfil de salida de la competencia digital para los alumnos de secundaria, que se pretende utilizar junto a un recurso educativo de nueva creación denominado EKI. Son escasas las investigaciones que tienen en cuenta un recurso educativo para tratar la competencia digital. El estudio parte de la premisa de que el recurso educativo EKI es un recurso educativo innovador mediante el cual los alumnos de secundaria desarrollan su competencia digital, y que la competencia digital se considera una competencia transversal para los alumnos de secundaria. El objetivo general de la tesis es analizar si el uso del recurso educativo EKI es suficiente para alcanzar el perfil de salida de la competencia digital definido para el alumnado vasco de secundaria.

En primer lugar, se realiza una revisión de las investigaciones y fundamentos teóricos relevantes en materia de competencia digital, centrándose en el recurso educativo EKI para el desarrollo de la competencia digital del alumnado de secundaria. En segundo lugar, metodológicamente, la tesis utiliza el diseño exploratorio como método de investigación con un enfoque descriptivo para estudiar los aspectos de la integración de la competencia digital en el recurso educativo EKI. La competencia digital de los estudiantes de secundaria se operativizó en este estudio a través de tres conceptos teóricamente interrelacionados: recurso educativo a nivel de asignatura, área de competencia digital y nivel de competencia digital. En tercer lugar, la pregunta principal de la investigación se ha operacionalizado a través de cuatro sub-preguntas y cada una de ellas se ha explorado mediante un sub-estudio individual.

Los resultados demuestran el complejo proceso para cumplir con todo el perfil de salida de la competencia digital a través del recurso educativo EKI. Aunque se identificaron todas las áreas de competencia digital a través de las actividades, no todas las áreas se desarrollan de la misma manera. Además, al analizar las actividades por asignatura escolar y área de competencia digital, fue difícil saber por qué algunas asignaturas escolares facilitan el desarrollo de las competencias digitales.

Palabras clave: competencia digital, alumnos de secundaria, recurso educativo EKI, material didáctico, educación secundaria

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Chapter 0: Introduction

Information and communication technology (ICT) has become an important part of both society and the every lives of people (Gudmundsdottir, Gassó, Rubio, & Hatlevik, 2020). Access to and use of ICT has increased extremely in society, at home and in schools. Because we use technology in all aspects of our everyday lives, - for entertainment, to search information about everything, communicate with friend and family, etc. – the way information is retrieved, used and disseminated has been transformed (Tondeur, Forkosh-Baruch, Prestridge, Albion, & Edirisinghe, 2016). Due to that, the demand for digital competence has increased and as a result, ICT use has influenced in competence development, learning and each person's employability (Martínez-Cerdá, Torrent-Sellens, & González-González, 2020).

Within the education sector, digital competence involves students as well as teachers, school leaders and teacher educators (Gudmundsdottir et al., 2020). Both the school environment and the role of the teacher has changed (Askar & Umay, 2001; Britland, 2013; Hatlevik & Christophersen, 2013), due to the increasingly focus on ICT use on management and teaching-learning tools. As mentioned above, digital technologies, which comprise several terms like ICT computers, laptop, learning management system (LMS) and digital media (Olofsson, Lindberg, Fransson, & Hauge, 2011), are becoming a central part of the everyday work, forcing teachers to rethink and transform what they have done until now by means of technology (Pettersson, 2018). That is why teachers are now seen as key to support their pupils' development of digital competence (Choi, Cristol, & Gimbert, 2018; Sarkar, 2012; Vuorikari, Punie, Gomez, & Van Den Brande, 2016). Nowadays teachers are experiencing increased access to technology and ICT use (Mueller, Wood, Willoughby, Ross, & Specht, 2008; Prestridge & Tondeur, 2015) and as a result, this technology-rich environment influences how teachers learn about and engage with subject content and pedagogical practices (Burden, Aubusson, Brindley, & Schuck, 2016).

Similarly, students' use of ICT in school has also gained substantial attention in recent years, and digital competence is now concerned as an essential competence for full participation in the 21st century society (Ananiadou & Claro, 2009). In the Basque Autonomous Community (BAC), students and teacher are expected to use technology in all school subjects at secondary school, and digital competence is regarded and defined as a key competence for students (Basque Government, 2015b).

The radical shift from face-to-face teaching to online secondary education in response to the Covid-19 pandemic was unimaginable. The short timeline for the transition to online teaching and learning has resulted in insufficient time for teachers to develop and plan (Howard, Tondeur, Siddiq, & Scherer, 2020). Although the immediate transition from face-to-face teaching has passed, and many students and teachers around the world have returned to the classroom, school practise will forever change.

Nevertheless, despite investing and increasing access to technology in schools (Fernández Olaskoaga, Correa Gorospe, & Ochoa-Aizpurua Agirre, 2013), there still appears to be a gap between the technology available in classrooms and the use of this technology for educational purposes (Bate, Day, & Macnish, 2013; Kopcha, 2012; Petko, 2012). All through late years, attempts have also been made to discuss the teaching aspects of digital abilities from a contextual perspective. From contended, for instance, that the pedagogical aspect of digital abilities should not only be viewed as a separate set of skills and abilities embedded at the teacher level, but also within and throughout the school organization. While an extensive literature exists on students' digital competence (Calvani, Cartelli, Fini, & Ranieri, 2008; Edvard Hatlevik, Björk Guðmundsdóttir, & Loi, 2015; Hatlevik & Christophersen, 2013; Li & Ranieri, 2010; Redecker & Punie, 2017), little is known about how school subjects could facilitate the development of digital competence. Therefore, a main goal for this thesis is to gain knowledge about how educational resources and subjects could help to develop students' digital competences.

Chapter 1: Education in digital society

1 THEORETICAL BACKGROUND

In this chapter, I will present an overview of prior studies that is considered relevant to the study. The main aim of the chapter is to place my thesis within the context of the regional- and international research landscape of digital competence in education and students' digital competence. A comprehensive literature review of current work within the scope of the thesis is a foundation and a prerequisite for successful research (Boote & Beile, 2005). According to Creswell (2017), a literature review can serve a variety of purposes. First, it helps to share the results of related studies with target audience. It also fills the gaps and links the study to the unceasing dialog in the field of research (Creswell, 2017).

1.1 COMPETENCE BASED EDUCATION (CBE)

The term competence is used in various contexts and is given a number of meanings. The literature also represents a discussion on the essence of the principle of competency. To explain and understand the origins of this issue, it is first important to encapsulate relevant knowledge related to the definition of "competence" and the paradigm of "competence-based education (CBE)."

Guthrie, Petty, Yongvanich and Ricceri (2004, p. 5) demonstrate that the idea of competence is formed and developed as it moves down its exploratory way (p. 5). Different researchers in this area understand the challenge in identifying a clear and detailed concept in competence and competence-based education (Hackett, 2001).

Spady (1977, p. 10) defines competencies as indicators of good performance in life-role tasks as distinguished from distinct cognitive, manual and social capacities. Chickering and Claxton (1981, p. 11) note that competence is internal and external, situational and personal; competence is constrained by the understanding, neurological structure, and character of a person; the accomplishment of competencies involves a variety of learning styles; competence itself is a motivating power.

Raylatt and Lohan (1997, p. 47) make the assumption that competence is a summary of the basic skills, knowledge and attitudes needed for successful performance in a work situation, while Bridges (1996) indicates that one of the characteristics common to all types of competence is the emphasis on what people do and how they perform effectively in a variety of contexts. In the same sense, Carraccio, Englander, Ferentz, Martin and Wolfsthal (2002) define competence as a complex set of behaviours built on the components of knowledge, skills, attitudes, and also they suggest competence as a personal capacity.

Similarly, the DeSeCo framework for key competences offers a clear concept of competence in order to tackle increasingly complex problems such as balancing economic development with environmental protection. For that reason, sustainable development and social stability are critically dependent on the competencies of all our people – with competencies understood to include expertise, skills, attitudes and values (DeSeCo, 2005).

Moreover, Storey (2001) argues that competence is a complex process that shifts as experience, knowledge and skills grow through and in practice, thus that should be seen as a continuum. Furthermore, Edwards, Sanchez-Ruiz, and Sanchez-Diaz (2009) within the project named "Tuning Educational Structures in Europe" (Sotés, 2003), competence is regarded as a complex set of attributes with respect to theory and practice, attitudes and responsibilities that describe the outcomes of learning in a given subject, or how students should be able to develop at the end of the training process.

Initial uses and implementations of the CBE concept, in the second half of the 20th century, are the most highly regarded developments in education (Gonder, 1978). Empirical research on competence-based education is remarkably limited, especially in terms of the effect of competence-based education on student performance and application (Ryan & Cox, 2017; Sturgis, 2016).

Norris (1991) points out two separate hypotheses or principles of competence: behavioural construct and cognitive construct. While in behavioural construct, competence is viewed as something an individual is or should be able to do and it is a definition of the process, conduct or result capable of being demonstrated and assessed; in cognitive construct, competence is defined as what a person knows and can do in ideal situations (Norris, 1991).

Hager and Beckett (1995) conceptualize competence definition in terms of knowledge, abilities, skills and attitudes demonstrated in a carefully chosen set of practical professional activities or deliberate acts at the correct conceptual level. Marope, Griffin and Gallager (2017, p. 27) described competence as the capacity of growth to organize and use information, data, expertise, skills, values, attitudes and technology in an engaging and ethical manner to engage effectively and act through diverse 21st century contexts to achieve individual, collective and global good.

However, the introduction of competence into the field of education, especially from a curriculum perspective is not recent. The application of competence concept to education inherently creates a number of problems (Jonnaert, Barrette, Masciotra, Yaya, & Morel, 2006). Until only few years, education was based on content, which is known as traditional model or viewed as traditional education. The traditional model defines curricula and learning in terms of subject content and is focused on subject knowledge acquisition (Lobanova & Shunin, 2008). It

is a behavioural learning education system, theoretically oriented and ideologically managed (Ramirez, 2012). To be successful, learners must engage mentally with lower cognitive levels through memorization or a role learning process and usually measurement of knowledge is usually done through written and oral test (Lilly, 1979). In this model competence is defined as being able to complete a wider variety of tasks and its significance is poor.

By the contrast, competence-based education focused on developing key competencies necessary to live in a contemporary knowledge society. In the recommendation of the European Commission on key competences for lifelong learning (2018b), they set out eight key competences: literacy competence; multilingual competence; mathematical competence and competence in science, technology and engineering; digital competence; personal, social and learning to learn competence; citizenship competence; entrepreneurship competence; cultural awareness and expression competence.

Similarly, Loewenberg and Forzani (2009) declared that a competence-based education should be based on an integrated and problem -based curricula. Lobanova and Shunin (2008) suggested that the complexity of activity in a contextual situation gives rise to the development of competences. Likewise, the European Commission (2006), points out that competencies require more than knowledge and understanding and take into account the willingness to do so while performing a task (skill) and how – with what mind-set – the learner approaches the task (attitude).

Moving towards a competence-based-oriented approach to education, training and learning requires a paradigm shift. This influences not just the structure of curricula, but also the organization of learning. Implementation of skills-based education, training and learning often requires cross-curricular approaches, greater emphasis on interactive learning and teaching styles, a combination of formal and non-formal and informal learning, greater collaboration with non-educational stakeholders and local communities, a new role for teachers, trainers and educators in guiding learning processes, and new assessment approaches (European Commission, 2018b).

According to Jonnaert, Masciotra, Barrette, Morel and Mane (2007), the adoption of competence as the guiding principle of the curriculum requires a variety of steps in order to ensure that the meaning implicit in the definition of competence is upheld in the education system, from the principles adopted by the curriculum to their application in the classroom. The first step is to define a variety of situations and then to organise them into situations in the exit profiles. The exit profiles in a competence-based education identify the groups of circumstances that learners will be able to deal with competently by the end of their compulsory education. Such classes of situations are defined, depending on the form of schooling, for example, on the

basis of the real situations of the target population. Defining the exit profiles is therefore a first step in defining the tools or learning resources required to deal with situations (Jonnaert, 2003). Until now, the conventional method of curriculum creation, based on content, has been reversed.

To conclude this section, the literature identifies that developing a curriculum, in terms of competence and objectives, depends of the manner in which the responsible for the education system perceive and define them. Thus, the term of competence can have interpretations that vary from country to country, or region to region.

1.2 TOWARDS A DEFINITION OF DIGITAL COMPETENCE

In 2006, the European Commission (2006) published a recommendation identifying eight key competences for lifelong learning: communication in the mother tongue; communication in foreign languages; mathematical competence and basic competences in science and technology; digital competence; learning to learn; social and civic competences; entrepreneurship; and cultural awareness and expression. In the recommendation competences were defined as a confluence of knowledge, skills and attitudes that are relevant to the context (European Commission, 2006, p. 5), while key competences were defined as those needed by all individuals for personal fulfilment and development, citizen participation, social integration and work opportunities (European Commission, 2006, p. 5). Digital competence is pointed out as fundamental basic skill and defined in the recommendation as a competence that involves the confident and critical use of Information Society Technology (IST) for employment, social activities and communication purposes. It underpins basic ICT skills: the use of computers to retrieve, evaluate, store, create, present and share information, and to interact and engage in collaborative networks over the Internet (European Commission, 2006, p. 9).

In 2018 the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions (2018a), declared that digital competence continued being part of the revised European Reference Framework of Key Competences for Lifelong Learning which all citizens should have. Additionally, digital competence is defined as the confident and critical use of digital technology and covers the knowledge, skills and attitudes that all citizens need in a rapidly evolving digital society.

1.2.1 CONCEPTUALISING DIGITAL COMPETENCE

Although the ability to use technology effectively is considered a key competence by the European states, many different terms are used to describe these skills and competencies. Ala-Mutka (2011, p. 15) declared that the review of the literature and initiatives relating to digital competence revealed a complex landscape of definitions and concepts. Aesaert et al. (2013) carried out an analysis of educational technology curricula at primary school level in England, Norway and Flanders, paying special attention to the conceptualization of digital literacy and digital competences within the studied curricula. The research results indicate that:

> The results indicate that national governments define digital literacy in their curricula in different and sometimes diverging ways. Different terms refer to the concept of digital literacy, such as digitally skilled, digitally competent, digitally literate, ICT competent and ICT capable. Not only are different terms used, each of their definitions contains different semantic meanings, ranging from the use of basic ICT skills to complex problem-solving abilities. This permissive use of concepts in national educational technology curricula supports Mark-auskaite's (2006) view that the notion of digital literacy is poorly understood in formal education and many terms are used to describe various sets of technology related capabilities. (Aesaert et al., 2013, p. 143).

Similarly to the research of Aesaert et al. (2013), Ilomäki et al. (2016a) found that the most frequently used term was, digital literacy, followed by, new literacies, media literacy, multiliteracies and digital competence. Ilomäki et al. (2016a) determined that the term digital competence was a relatively new term in the research articles. Bawden (2001) also in his review of concepts related to information and digital literacies, defined the use of technology in terms of information literacy, computer literacy, library literacy, media literacy, network literacy, Internet literacy and digital literacy.

Different concepts have been used to define and analyse how students make use of computers in learning (Ala-Mutka, 2011), including digital competence (Calvani, Fini, Ranieri, & Picci, 2012; Ferrari, 2013), digital literacy (Aviram & Eshet-Alkalai, 2006; Gui & Argentin, 2011), Internet skills (Litt, 2013; van Deursen, van Dijk, & Peters, 2011, 2012), digital skills (Zhong, 2011) and media literacy (Livingstone, 2004). Hatlevik et al. (2015) declare all these concepts consist of a domain part (for example, 'media', 'digital', 'internet') in conjunction with a specific knowledge perspective (for example, 'skills', 'competence', 'literacy'). Those concepts have vary depending by the dominant technology of that era, how it was used and the further evolution of the technologies.

1.2.2 DIGITAL LITERACY AS THE MERGE OF MULTIPLE LITERACIES

Over the last few years, the concepts digital competence and digital literacy have been used more frequently and have been increasingly discussed, in terms of what kind of skills and expertise people should have in a knowledge society, what to teach students, and how to do that (Ilomäki et al., 2016a). Often, they are used synonymously although they have distinct origins and meaning (Iordache, Mariën, & Baelden, 2017).

Many possible definitions exist and to do a precise definition focusing on ability and skills without taking into account the understanding is hard to find. Focusing in the evolution of the terms, it is clear that almost all the literacies mentioned above, have an initial narrow base.

Computer literacy is an ambiguous term conceived by Andrew Molnar in 1972. He defined computer literacy as the basic skills in the use of computer systems, which involve trying to understand the notions, terminology and procedure related to the general use of computer systems, from the point of view of the need for social skills (Molnar, 1991). Hunter (1983) detailed computer literacy as whatever a person needs to be able to do with computers and know about computers in order to function in an information-based society. Some years later, Bawden (2001) describes computer literacy from a pragmatic approach, focusing on basic computer skills and the ability to perform particular functions. Ala-Mutka (2011, p. 23) notes a similar early focus: ‘computer literacy often results in educational settings in tool-oriented approaches, where teaching is reduced to relatively trivial software instruction’.

Models of definitions of computer literacy and information literacy started to merge when the focus of specific devices (such as computer) moved towards the information they handle. The main reason for this change is based on the rapid growth of technology, and its increasing impact on society. Information literacy was defined as a set of abilities requiring individuals to recognise when information was needed and have the ability to locate, evaluate, and effectively use needed information (Association of College, Research Libraries, & American Library Association, 2000). Being fluent in both technology and information became necessary to develop a single notion of literacy (Hoffman & Blake, 2003). UNESCO reports that information literacy is an integral aspect of adult competences and today very much related to information and communication technologies. People may be information competent in the absence of ICT, but the quantity and variable quality of digital information and its role in knowledge societies have highlighted the need for all individuals to acquire information literacy skills. Access to information and the capacity to use ICT are prerequisites for people to use information literacy within a knowledge society (Catts & Lau, 2008).

Bawden (2001) declared in his review that a link between information literacy and learning has been a consistent theme in the development of the concept, and has strongly influenced the meaning of the term. Ala-Mutka (2011) reports that information literacy involves the capacity to recognize why and how we need information, as well as builds on cognitive sciences and relies on higher order thinking skills, including critical thinking. Newman (2008) detailed that the critical thinking skills are seen as an attribute of information literacy and as consequence, the focus is more on thinking rather on technical skills. Indeed, information literacy is sometimes used as a synonym for digital literacy.

The term digital literacy was first used and defined by Gilster (1997) in the late 1990s as the ability to understand and use information in multiple formats from a broad variety of sources when viewed through computers. The concept of literacy goes beyond simply being able to read; it has always meant being able to read with meaning and to understand. This is a fundamental act of cognition. Digital literacy also expands the meaning boundaries. It's a perception of what you see on your computer screen when you use a networked device. Its locations demand that you have always been present, albeit less visible, in the analog media of the newspaper and the TV. At the same time, it presents a new set of challenges that require you to approach networked computers without any preconceptions. Not only do you have to acquire the ability to find things, you also have to acquire the ability to use those things in your life.

However, Hoffman and Blake (2003) mention that digital literacy is simply another form of literacy, mastery of which was becoming necessary to be literate in a world that so heavily relied on computer technology. Also in 2003, the European Commission (2003, p. 3) reported digital literacy as fast becoming prerequisite for creative innovation and entrepreneurship, and without it citizens can neither participate fully in society nor develop the skills and knowledge needed to live in the 21st century. Moreover, Martin and Grudziecki (2006) report results of a European project, in which they elaborated a comprehensive definition for the concept of digital literacy as the awareness, attitude and capacity of individuals to make appropriate use of digital resources and facilities to recognize, access, manage, integrate, evaluate, analyse and synthesize digital resources, build new knowledge, create media expressions, and communicate with others in the context of particular life situations in order to allow for meaningful social action; and to reflect on this process.

In recent publications, digital literacy definitions are focused on cognitive and social skills and competences (Mishra, Wilder, & Mishra, 2017). As Mcmahon (2014) points out that the concept of digital literacy involves a far more complicated learning cycle involving a combination of technological, operational, cognitive and socio-emotional skills. Stordy (2015) reported a literacy framework consisting of six perspectives on literacy, defining such literacies as the ability of a person or a social group to generate meaning when interacting with digital

tools and the social, learning and work-related practices to which these skills are applied. Stordy (2015) notes that the definition above encapsulates the growing importance of literacy as cognitive skills and social practice. Novakovich (2016) determined digital literacy as social practice, while Chan et al. (2017) define digital literacy from a cognitive skills perspective as the ability to grasp and use information in different formats with focus on critical thinking rather than information and communication technology skills.

1.2.3 FROM LITERACY TO COMPETENCE

Despite their common usage, digital literacy and digital competence are used in a range of different disciplines in most parts of the world to mean different things. Janssen et al. (2013a) argue that digital literacy is more often used in European policy whereas competence is employed more in an educational context. The understanding of competence is inspired by OECD's Definition and Selection of Competences (DeSeCo) project (Rychen & Salganik, 2001), where competence is understood as ability to meet diverse needs, by drawing on and mobilizing psychosocial resources (including skills and attitudes) in a specific context (Rychen & Salganik, 2001). According to this, Janssen et al. (2013a) argue that competence encompasses a wider educational conceptualisation that includes knowledge skills and attitudes towards digital technologies. Similarly, Aesaert et al. (2013, p. 132) define digital competence as integrated and efficient use of digital knowledge, skills and attitudes.

However, Aviram and Eshet-Alkalai (2006) and Eshet-Alkalai (2004) have developed a global framework for the digital literacy concept. In a study conducted by Alkalai and Amichai-Hamburger (2004), digital literacy was defined as a survival skill in the technological era, which helps users to carry out different digital tasks. By the contrast, Coiro, Livingstone, Van Couvering, Thumin, Knobel, Lankshear and Leu (2008) highlight that competence acquisition in a digital era should be defined as a mindset, enabling the user to adapt to new requirements set by the evolving technologies. According to this, many literacies concepts have been developed, which change very rapidly. Ala-Mutka (2011) reported that many of the literacy ideas that originated in pre-digital environments were then developed and expanded with the advent of new technologies and media platforms. This growth is likely to accelerate and attempting to lock ideas into one description would not only be impractical but would also easily lose its significance.

The European Commission (2006) report make clear the different terms used with regard to competence and literacy. The European Commission (2006) argued that digital literacy is needed to achieve digital competence suggesting that digital competence is more broad-ranging that digital literacy. A study by Petersson (2018) points out that in general, digital competence also refers to the skills and expertise required to help the ordinary person to understand and

manage the digitalized information environment. Similarly, Ferrari (2012) suggests, moving for competence instead of literacies involves taking into account behaviours that are frequently set aside in certification and assessment discourses, but which are so interconnected with expertise and abilities that it is often impossible to distinguish.

1.2.4 MOVING TO DIGITAL COMPETENCE

Having discussed through various concepts about the skills and competences related to activities in the information society, the following section aims to explore more in depth the concept of digital competence and its characteristics.

The Organisation for Economic Cooperation and Development (OECD) described digital competence as the ability to meet complex demands, by drawing on and mobilising psychosocial resources, including skills and attitudes, in a particular context (2005). Simultaneously, in a reference framework developed by the European Commission, digital competence was defined as one of the eight key competences for lifelong learning. In the framework competences were defined as a mixture of knowledge, skills and attitudes that are relevant to the context (European Commission, 2006, p. 5), while key competences were defined as those required by all individuals for personal satisfaction and growth, active citizenship, social inclusion and employment (European Commission, 2006, p. 5). Notwithstanding all key competences were considered important, the framework emphasised that the fundamental basic skills, language and communication, literacy, numeracy, use of technology, and learning to learn were seen as competences that support all learning activities and were essential foundations for learning. The European Commission framework defined digital competence as digital maturity includes the effective and vital use of Information Society Technology for employment, recreation and connectivity. It underpins basic ICT skills: the use of computers to download, analyse, archive, create, display and share information, and to interact and engage in shared networks over the Internet (European Commission, 2006, p. 9).

Using this approach, Ferrari (2012, p. 30) summarised and defined digital competences as digital competence is the collection of expertise, talents, behaviours, capabilities, techniques and awareness required to conduct tasks across ICT and digital media; to solve problems; to communicate; to organize information; to collaborate; to produce and exchange content; and to develop knowledge effectively, reliably, correctly, objectively, creatively, individually, flexibly, ethically and reflectively for work.

The above definition of digital competence demonstrate that digital competence is a transversal competence which influences in many aspects of our lives; it is defined as a competence for work, leisure, and for participating fully in society. In a similar way, Røkenes and Krumsvik (2014) report that digital competence involves a wide range of skills including cognitive and

emotional skills as well as sociological knowledge to perform effectively in a digital environment.

At this point is important to clarify the differences between the definitions of the terms skills and competence, and how are linked. A clarifying and understanding definition of both terms is one provided by the OECD's DeSeCo project: competence is more than mere knowledge and skills. It requires the capacity to satisfy specific needs, by building on and mobilizing psychosocial tools (including skills and attitudes) in a given context. For example, the capacity to communicate efficiently is a capability that can rely on an individual's understanding of language, functional information technology abilities and attitudes towards others with whom he or she communicates (OECD, 2005, p. 4).

1.2.5 DIGITAL COMPETENCE FRAMEWORKS

There is a great amount of literature in reference to describe the different dimensions of digital competence. Nevertheless Ala-Mutka (2011) identifies many different skills, knowledge and attitudes that should be included in the digital competence definition.

After the definition of digital competence provided by the European Commission (2006) described in previous chapters, Calvani et al. (2008) (see Figure 1) propose a digital competence framework definition around three main dimensions and also their integration: technological, ethical and cognitive aspects.

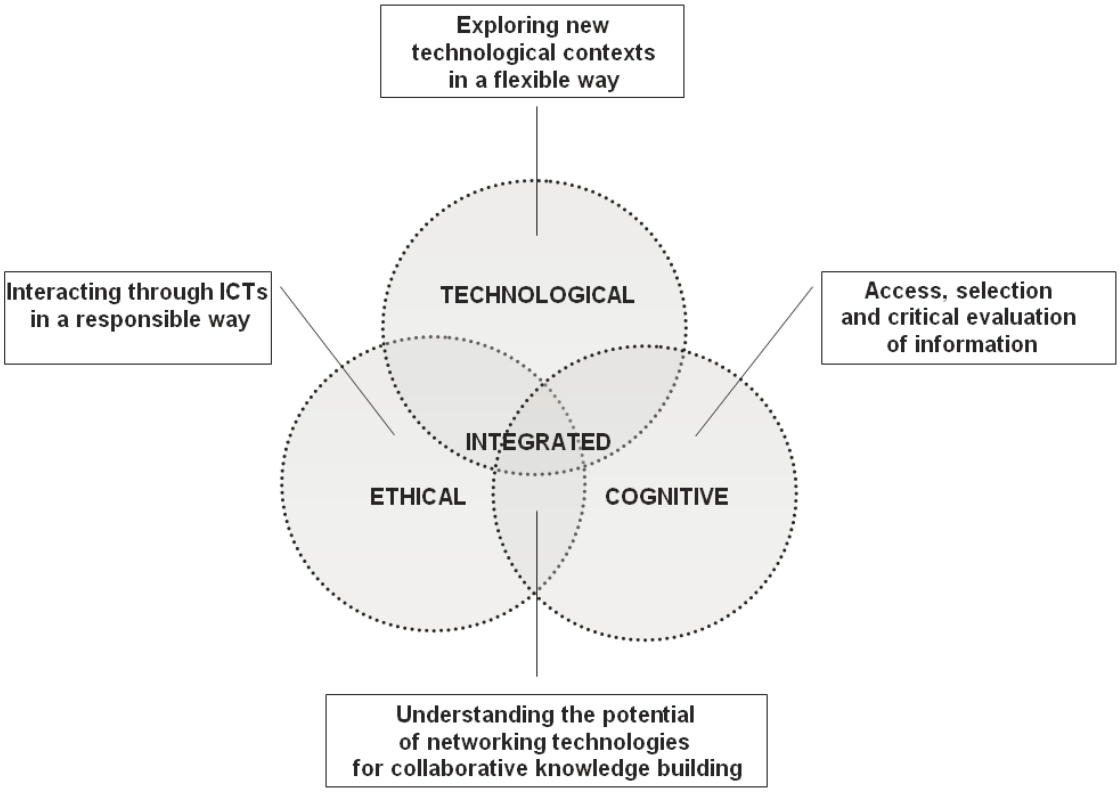


Figure 1: Digital Competence Framework (Calvani et al., 2008)

Likewise, Ng (2012) provide a digital literacy model, which includes technical, cognitive and socio-emotional dimensions. In the same model (see Figure 2) are defined the basic skills that every digitally literate person should acquire: carry out basic computer-based operations and access for everyday use; search identify and assess information effectively for the purposes of research and content learning; select and develop competency in the use of the most appropriate technological tools or features to complete tasks, solve problems or create products that best demonstrate new understandings and behave appropriately in online communities and protect oneself from harm in digitally enhanced environments (Ng, 2012).

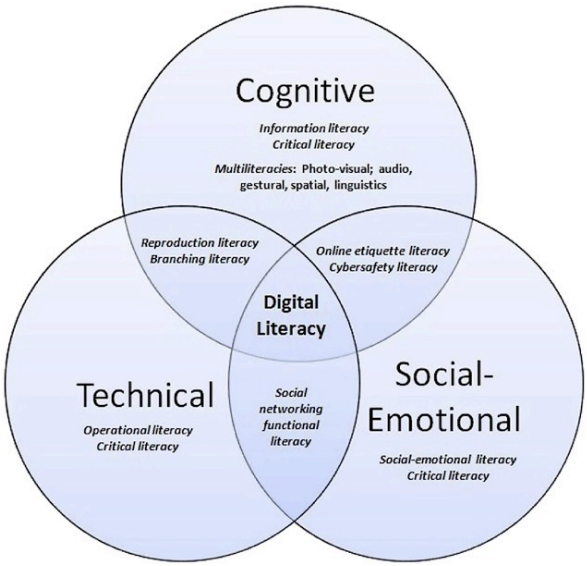


Figure 2: Digital literacy model (Ng, 2012)

In 2012, a framework for basic skills was developed by the Norwegian Directorate for Education and Training (2012). In this framework, the same skills that were defined in 2006 were re-defined as oral skills, reading, writing, digital skills and numeracy. Digital skills are defined as digital skills include being able to use digital tools, media and services effectively and safely, to conduct specific tasks, to identify and manage knowledge, to create digital goods and to distribute content. Digital capabilities can require improving technical decisions through the development of knowledge and effective techniques for accessing the Internet (Norwegian Directorate for Education and Training, 2012, p. 12). Digital skills are divided into four sub-categories: search and process, produce, communicate and digital judgement. The framework was developed as a tool for the development and revision of the national subject curricula and contains definitions of the five basic skill mentioned above, descriptions of their functions at different levels of education and what is required at the different levels.

Janssen et al. (2013a) conducted a Delphi study in which identifies twelve different areas that englobes digital competence composing of knowledge, skills, and attitudes (see Figure 3).

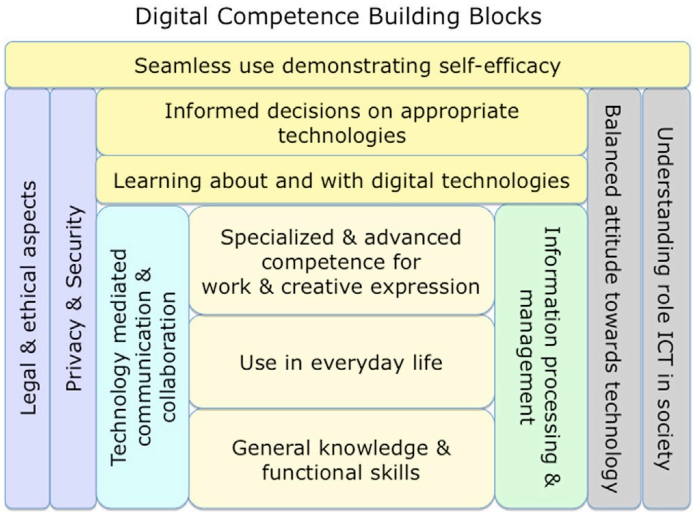


Figure 3: Areas of digital competence: expert's collective view (Janssen et al., 2013)

Ferrari (2013) identified five key areas of competence within the project DigComp, funded by the European Union. The digital framework proposed by Ferrari (2013) describes those five key competences as:

1. Information: identify, locate, retrieve, store, organise and analyse digital information, judging its relevance and purpose.
2. Communication: communicate in digital environments, share resources through online tools, link with others and collaborate through digital tools, interact with and participate in communities and networks, cross-cultural awareness.
3. Content-creation: create and edit new content (from word processing to images and video); integrate and re-elaborate previous knowledge and content; produce creative expressions, media outputs and programming; deal with and apply intellectual property rights and licenses.
4. Safety: personal protection, data protection, digital identity protection, security measures, safe and sustainable use.
5. Problem-solving: identify digital needs and resources, make informed decisions as to which are the most appropriate digital tools according to the purpose or need, solve conceptual problems through digital means, creatively use technologies, solve technical problems, update one's own and others' competences.

Some years later, a revision (Vuorikari et al., 2016) of the original framework of digital competence, DigComp (Ferrari, 2013), redefined the dimensions, maintaining the overall structure of five competence areas – information, communication, content creation, safety and problem solving. The table below makes the comparison between the five competence areas definition.

Table 1: Comparison of the five areas DigComp 1.0 and 2.0 (Vuorikari et al., 2016)

	Competence areas version 1.0	Competence areas version 2.0
Inter-related areas with overlapping points and cross-references	1. Information	1. Information *and data literacy*
	2. Communication	2. Communication *and collaboration*
	3. Content creation	3. *Digital* content creation
Cross-cutting across all areas	4. Safety	4. Safety
	5. Problem solving	5. Problem solving

Actually, due to a decree issued by the Basque Government (2015a), which establishes the curriculum for Basic Education and its implementation in the Basque Autonomous Country, regulates digital competence. The decree is based on the educational model and in the framework of pedagogy of the Heziberri 2020 plan (Basque Government, 2015b), as in the framework DigComp (Ferrari, 2013), in which digital competence is defined as a transversal competence, competence for verbal and non-verbal communication and digital.

Students who have finished Basic Education must have acquired technical and media skills, in accordance with the European Digital Competence System, which ensures the maximum literacy and practical training provided by today's citizens (Basque Government, 2015a). The competence in verbal, non-verbal, and digital communication aims to use verbal and non-verbal and interactive communication in a complementary manner, so that one can communicate effectively and adequately in medical, social and academic contexts (Basque Government, 2015b, p. 30).

Furthermore, in line with what Basque Government says, in the same year also the Department of Education of the Catalonia Government (2015) has drawn up the guidelines for implementing core competencies in the field of information and communication technologies for students in compulsory secondary education with the goal of helping schools to develop and apply the curriculum currently in force in the digital field. Figure 4 describes the core competencies in the digital field every student should develop before finishing compulsory education.

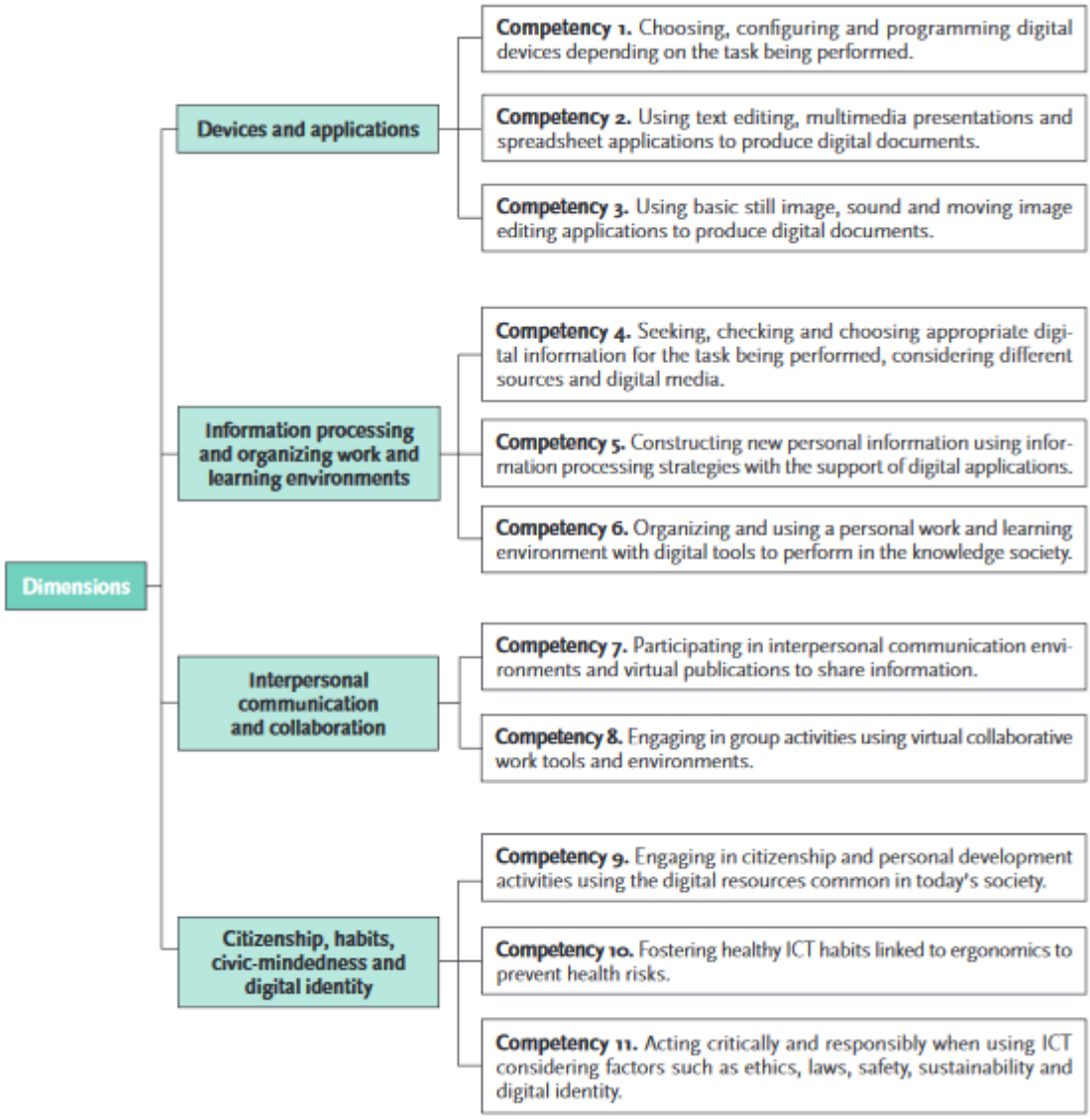


Figure 4: Core competencies in the digital field (Generalitat de Catalunya, 2015)

More recently, the Welsh government has renew its curriculum integrating digital competence in order to help teachers incorporate skills into the curriculum that will help all our learners thrive in an increasingly digital world (Welsh Government, 2018). The digital competence framework comprises four high-level strands, which are divided into elements. The digital competence framework sets out the digital skills to be attained by learners aged between 3 and 16 across four areas: citizenship, interacting and collaborating, producing and data and computational thinking. Each area is split into a number of characteristics, as shown in Table 2.

Citizenship	Interacting and collaborating	Producing	Data and computational thinking
• Identity, image and reputation • Health and well-being • Digital rights licensing and ownership • Online behaviour and cyberbulling	• Communication • Collaboration • Storing and sharing	• Planning, sourcing and searching • Creating • Evaluating and improving	• Problem solving and modelling • Data and information literacy

Table 2: Welsh Digital Competence Framework (Welsh Government, 2018)

1.3 DIGITAL COMPETENCE IN SCHOOL CURRICULA

This chapter presents an overview of how European education systems handle the development of digital skills for students in secondary education curricula. Looking at the priorities and goals set for the creation of this key competence in national curricula is a way of understanding the emphasis put on digital competencies by high-level education authorities. Not only being digitally competent is necessary to young people in order to be able to engage successfully in a digitalized society; but also they need to be able not perpetuate and increase structural inequalities (OECD, 2019).

As mentioned above, at European level, digital competence has long been acknowledged and defined as one of the key competences for lifelong learning. The European commission has defined as confident, critical and responsible use and interaction of emerging technologies for learning, work and involvement in society (European Commission, 2018b). DigComp framework (Ferrari, 2013) has become a common reference both at European and national level.

According to the report published by Eurydice (Bourgeois, Birch, & Davydovskaia, 2019), almost half of the European educational system refer to the European key definition of digital competence, while 11 educational institutions[1] only are using their own national definition. Although the use of the European key competence definition is widespread, it appears to be more common in southern and eastern European countries. Those countries that have their

[1] Germany, Croatia, Netherlands, Portugal, Slovakia, Sweden, United Kingdom (Wales and Scotland), Iceland, Norway and Turkey.

national definition of digital competence, have similar areas to those set out in the DigComp framework (Bourgeois et al., 2019).

In Portugal, the definition of digital competence in InCoDe 2030, the national digital competences initiative, the notion of digital literacy (i.e. the ability to access digital media and ICT, understand and critically assess content and communicate effectively) as well as the generation of new knowledge through research involving the processing of information and communication, interaction and production of digital content (Governo de Portugal, 2017). It is narrower than the interpretation of European key competences, because the definitions of protection, digital well-being and intellectual property rights are missing. However, basic skills and citizenship education are included in compulsory school curricula.

In Austria, the curriculum for 'Digital Basic Education' managed to successfully link digital and information and technology competences with media competence and socio-political competences addressed by digitisation (Federal Ministry for Digital and Economic Affairs, 2018). Teaching digital skills enables students to select, reflect and adapt relevant resources and methods for different situations in an academic, professional and private context on the basis of a comprehensive overview of current digital tools. The development of competencies in the area of emerging technologies is also carried out in a holistic manner and always takes into account the prerequisites and implications, the advantages and drawbacks and social impact of the use of technology.

The Federal Ministry of Education, Science and Research of Austria has started working on a master plan for digitisation of education. The aim is to gradually and, above all, at national level, incorporate the changes resulting from progressive digitisation into the Austrian education system by the end of 2023. The master plan for digitalisation (Bundesministerium für Bildung Wissenschaft und Forschung, 2018) pursues the following objectives:

- Innovation in technique and teaching by the use of digital learning tools in a professional way.
- Age-appropriate promotion of digital skills and information, as well as the creation of critical awareness along consistent pedagogical lines in all forms of education and school classes.
- Increase interest in technology and technological progress, particularly among girls.
- Reliable teaching of digital skills, competencies and information needed for a productive transition to the job market.
- Promote the creative potential of digitalisation among pupils and encourage talented pupils.

Schools decide for themselves whether to teach compulsory "digital basic education" in special lessons or to be integrated into other subjects. As part of the compulsory course, students acquire skills from these fields (two to four hours per week and year over a period of four years) (Federal Ministry for Digital and Economic Affairs, 2018), such as, social aspects of media change and digitalisation; information-, data- and media literacy; operating systems and standard applications; media design; digital communication and social media; safety; technical problem solving and computational thinking.

The Dutch digital competence definition stated in the curriculum differentiate four domains that are interdependent: basic information and communication technology skills, information skills, media literacy and computational thinking (Dutch Government, 2019). In accordance with the concept of European key competences, therefore, there is a greater emphasis on media literacy and computational thinking, similar to Wales digital competence curriculum (Welsh Government, 2018). The Dutch digital competence is divided in six main areas: data and information; security and privacy in the digital world; the operation and (creative) use of digital technology; digital communication and cooperation; digital citizenship and digital economy.

In other countries, such as Ireland, the Digital Learning Framework for Schools (Irish Department of Education and Skills, 2017) sets out criteria with due regard to both the UNESCO Competency Framework (UNESCO, 2018) and the European DigComp Framework (Ferrari, 2013). In Norway, the current curriculum is under revision, but it is expected to take effect from 2020-2021 school year. Nevertheless, the Norwegian Directorate for Education and Training (2012) states that digital skills include being able to use digital devices, media and resources effectively and responsibly, to solve practical problems, to find and process knowledge, to develop digital products and to communicate material. Digital skills may include improving technical judgment through the development of knowledge and effective strategies for the use of the Internet.

In Denmark, they are testing how the subject named ‘technological comprehension’ can be taught as a separate subject and how to incorporate into other subjects. Notwithstanding the renewing process, the subject purpose is to students must develop professional skills and acquire skills and knowledge so that they can participate constructively and critically in the development of digital artefacts and understand their relevance (Børne og undervisningsministeriet, 2020).

In Switzerland a national digital competence framework does not yet exist. Digital competence does not appear and is not given a transversal status in educational policy. However, Seufert (2017) declare that a national digital competence framework as a spiral curriculum with transversal educational policy status should be developed and the framework should explicitly

put emphasis across educational levels. Although cantons are free to decide how to organise the teaching and learning with ICT, Seufert (2017) suggest that the digital competences should be embedded within and across other transversal competences and core subjects, as well as that digital competences needs to be acknowledged and taken into account in formal and informal education contexts.

In Scotland, digital competence term does not exist, but they have a digital literacy in the curriculum. Digital literacy covers the skills required to live, learn and work in a modern world. It includes the skills, knowledge, capabilities and attributes of the use of digital technology that enable individuals to develop their full potential in terms of learning, life and work. It encompasses the ability to use technology to engage in learning through information management, communication and collaboration, problem-solving and creativity, and the appropriate and responsible use of technology (Scottish Government, 2016). It is worth stressing that in Scotland, the curriculum is not compulsory, which means that digital competences are delivered by means of an entitlement rather than an obligation (Bourgeois et al., 2019).

In Quebec, as part of the Digital Action Plan (DAP) for Education and Higher Education, they develop a digital competence framework (Figure 5), which is regarded as a combination of skills necessary for the confident, critical and creative use of digital technologies to achieve learning, work, leisure and social inclusion or participation objectives (Ministère de l'Éducation et de l'Enseignement supérieur, 2019). Without ignoring the risks associated in the so-called digital divide, the framework demonstrates how digital technology can serve as a tool for integration. Digital universal design in education would make it possible for all people to use digital technology with no need for adaptation or special design, regardless of gender, age, situation or disabilities. The framework also adopts a competence-based approach. They defined the term competence as sophisticated know-how developed through the efficient mobilization of a number of different resources in a variety of related situations (Tardif, 2006). They explain that the implementation of the framework is an iterative process.

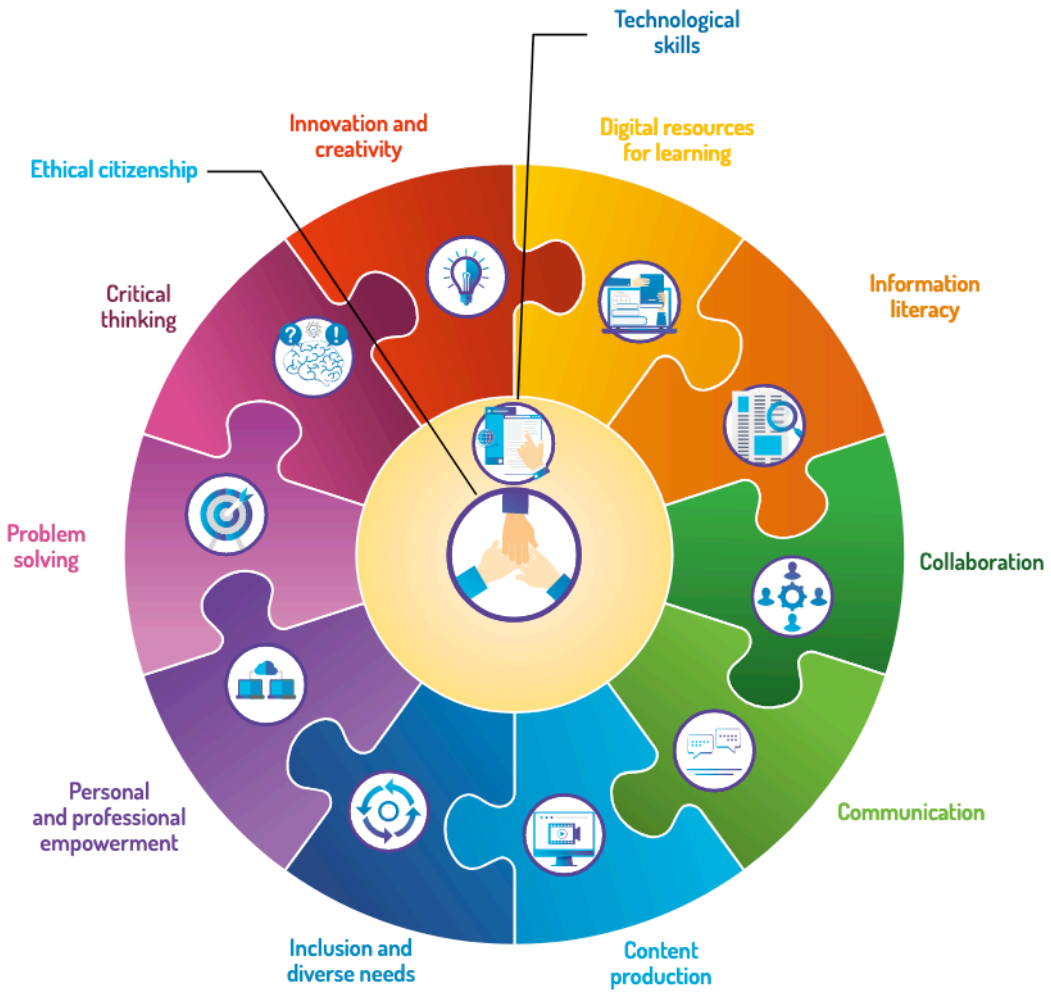


Figure 5: Quebec Digital Competence Framework (Ministère de l'Éducation et de l'Enseignement supérieur, 2019)

1.4 STUDENTS' DIGITAL COMPETENCE EXIT PROFILE

Throughout the last decade, large international organizations have produced reports that highlight the strategic role of digital technologies in the development of citizenship, identifying them as a determining factor in the processes of knowledge creation and learning (Gisbert, Prats, & Cabrera, 2015). In the educational field, the role of the European Commission stands out, which has led a series of theoretical frameworks regarding the use and contextualization of digital competence in all its policies (Bacigalupo, Kampylis, Punie, & Van den Brande, 2016; Bocconi, Chioccariello, Dettori, Ferrari, & Engelhardt, 2016; Carretero, Vuorikari, & Punie, 2017b, 2017a; Colucci et al., 2017; Conrads, Rasmussen, Winters, Geniet, & Langer, 2017; Ferrari, 2013; Kampylis, Punie, & Devine, 2015; Redecker & Punie, 2017; Santos, Punie, & Castaño Muñoz, 2016; Vuorikari et al., 2016; Witthaus et al., 2016) and since 2005 has published more than twenty studies focusing on learning and key competences in the digital society with the aim of improving the digital competences of citizens (Carretero et al., 2017b). Among these publications by the European Commission is "Digcomp: a framework for the

development and understanding of Digital Competence in Europe", the first version of which was published in 2013 (Ferrari, 2013) and focused on the terminology and conceptual model proposing a framework of digital competence with twenty-one competencies organized into five areas: information, communication, content creation, safety and problem solving. Vuorikari et al. (2016) in the second version, redefined the areas: information and data, communication and collaboration, creation of digital content, safety and problem solving. Later, in DigComp 2.1, the integral levels of each competency were more precisely defined, expanding from three to eight levels with the aim of facilitating their implementation in real contexts (Carretero et al., 2017a).

The Association of Basque Schools (Ikastolen Elkartea in basque) has defined a digital competence exit profile which every school student is supposed to reach by the end of compulsory education. The exit profile is based on the DigComp first version (Ferrari, 2013). The DigComp framework (Ferrari, 2013) proposes a set of digital competences for all citizens to achieve goals related to labour, learning, leisure and participation in society. A set of individual competences, 21 in total, are grouped into five competence areas, as mentioned above: information, communication, content-creation, safety and problem solving. For each individual competence, three different proficiency levels are defined: foundation, intermediate and advanced.

In the territory of the BAC, which this thesis is contextualised, following its line of innovating the learning process through competences, recognising the importance of including digital competences in curricula (Aesaert, van Braak, Van Nijlen, & Vanderlinde, 2015; Bourgeois et al., 2019) and incorporating by the administration the need for training in digital competences (Area Moreira, 2015), the new curriculum of Basic Education, which includes digital competence, was published (Basque Government, 2015a, 2015b).

The digital competence has been included as part of the transversal competence for verbal, non-verbal and digital communication. Such transversal competence is specified in order to allow complementary use of verbal, non-verbal and digital communication in order to interact efficiently and adequately in personal, social and academic circumstances (Basque Government, 2015a, 2015b). This transversal competence includes three components: Verbal Communication, Non-Verbal Communication and Digital Competence.

According to a definition provided by Basque Government (2015b, 2016, p. 23), digital competence is to use information and communication technologies creatively, critically, effectively and safely for learning, leisure, inclusion and participation in society. In order to develop in an appropriate way, the following issues should be addressed.

- Information: means being able to apply a wide variety of techniques to the search for information and navigation on the Internet, to know how to process and handle the information obtained. It also involves knowing who to follow on sites intended to share information on the internet, and it also means being critical of the information found by verifying its validity and credibility.
- Communication: it involves the use of a wide range of online communication tools (e-mails, chats, SMS, instant messaging, blogs, microblogs, forums, wikis); the ability to select the most appropriate modes and forms of digital communication. In short, to be able to handle the types of communications received and to adapt the styles and means of communication to the various recipients.
- Content creation: requires the ability to generate digital content in different formats, platforms and contexts and to be able to use various digital tools to create original multimedia products or to combine existing content elements to create new content, to know how different types of licenses relate (in terms of usage and reference) to the information and resources each person use.
- Security: means, on the one hand, ability to understand the vulnerabilities and hazards in the network and, on the other, knowing how to protect one's digital devices as well as updating security measures.
- Problem solving: this dimension involves identifying, and being capable of solving, possible simple technical issues.

As noted by the Basque Government (2015a, p. 5), students who complete their basic education must have gained digital and media competence in keeping with the European Digital Competence Framework (Ferrari, 2013), which guarantees the degree of full literacy or practical training expected by today 's people. This is something that is not measured on the basis of quantitative parameters for the usage and frequency of use of these tools, but on the basis of solvency in introducing new methodologies that will have to be applied in the various areas and circumstances of life in an acceptable, efficient, ethical and responsible manner, while maintaining the right to privacy of individuals.

In line with the DigComp framework (Ferrari, 2013) and following the guidelines set by Heziberri 2020 Pedagogical Framework (Basque Government, 2015b) as well as the Decree 236/2015 (Basque Government, 2015a), the Association of Basque Schools has defined a digital competence exit profile, in which minimum proficiency level that every Basque secondary student in those schools should achieve at the end of the compulsory education is defined (see Table 3). In order to every student obtain the minimum level of attainment of each digital competence, the EKI educational resource, has been developed. According to Ikaselkar

publisher and the Association of Basque Schools, due to the material and the exercises proposed on it, every student should achieve the minimum level of each digital competence defined on the exit profile.

1.5 SUMMARY

In this chapter a depth analysis of digital competence meaning has been carried out. Digital competence is clearly emerging as an essential part of school curricula in many countries in order to help students to become digitally competent citizens. Researchers, teachers and other stakeholders are unanimous in their view that the incorporation of digital competence on teaching and learning is a central aspect of 21st century education (Siddiq, Scherer, & Tondeur, 2016).

Although most of the digital competence frameworks are focused on students, also teacher need to get involved in the development of their digital competence. Previous studies have shown that ICT integration relies and digital competence development, to a large degree, on student and teacher attitudes towards their use of ICT (Hatlevik et al., 2015). However, it has also been pointed out that the effective integration of ICT involves a fundamental change in the core activities of schools (Scherer, Rohatgi, & Hatlevik, 2017).

This chapter summarize the examined literature that provided a theorical background and insight into the research goals.

Information	Communication	Content-Creation	Safety	Problem-solving
1.1 Browsing, searching and filtering information	2.1 Interacting through technologies	3.1 Developing content	4.1 Protecting devices	5.1 Solving technical problems
Advanced	Advanced	Advanced	Intermediate	Intermediate
1.2 Evaluating information	2.2 Sharing information and content	3.2 Integrating and re-elaborating	4.2 Protecting data and digital identity	5.2 Identifying needs and technological responses
Advanced	Intermediate	Advanced	Intermediate	Intermediate
1.3 Storing and retrieving information	2.3 Engaging in online citizenship	3.3 Copyright and Licences	4.3 Protecting health	5.3 Innovating and creatively using technology
Intermediate	Foundation	Intermediate	Intermediate	Intermediate
	2.4 Collaborating through digital channels	3.4 Programming	4.4 Protecting the environment	5.4 Identifying digital competence gaps
	Advanced	Intermediate	Intermediate	Intermediate
	2.5 Netiquette			
	Intermediate			
	2.6 Managing digital identity			
	Intermediate			

Table 3: Digital Competence exit profile for Basque secondary school students of Association of Basque Schools

Chapter 2: Education in the Basque Country

2.1 BASQUE EDUCATIONAL CONTEXT

The Basque Autonomous Community (BAC) is one of the 19 autonomous communities and cities that comprise the Spanish state. The Basque Autonomous Community which is located in the north of Spain has had two official languages (Basque and Spanish) since the reintroduction of democracy throughout the Spanish State and the creation therein of various politically autonomous communities.

Although the Basque Government has the major responsibility and power over education to set up their own system and law, it is still dependent on some decisions taken by the Spanish Government.

Regarding the educational system in the BAC, Table 4 shows the distribution of educational levels prior to university studies. An education law published by the Basque Government (1982), still in effect, regulates the presence of Basque in the education system, through the creation of language models, which differ in the language of instruction. In the BAC, the majority language in society is Spanish, with Basque being the minority language. Both languages have co-official status in the BAC and are compulsory in education. The Basque educational law (1982) recognized the right of Basque students to receive education in either of the two co-official languages, besides aiming to guarantee the practical knowledge of both. Since 1982, all parents have the right to choose the language of instruction and enrol their children in one of three bilingual models (Arocena Egaña, Cenoz, & Gorter, 2015).

Table 4: Pre-university education system in the Basque Autonomous Community

Age	Level	Character
2-6	Preschool education	Non-compulsory
6-12	Primary education	Compulsory
12-16	Secondary education	
16-18	High school and vocational training	Non-compulsory

Depending on the main language of instruction, students are classified into three different language models: Spanish, Mixed or Basque; known in the Basque Country as Models A, B or D. Model A is originally intended for students whose mother tongue is Spanish and choose to be instructed in Spanish. In Model A, during the period of compulsory education, all subjects are taught in Spanish; Basque is taught as a subject and as second language for three to five hours a week. The purpose of this model is to strengthen positive attitudes towards Basque culture, to help students understand the Basque language, and to prepare students to participate in Basque environments (Gardner, 2001).

Model B is aimed primarily at children who are Spanish native speakers and want to be bilingual in Spanish and Basque. Half of the instruction is carried out in Basque and the other

half in Spanish, but this can vary from school to school. The purpose of this model is to obtain adequate competence to perform in Basque as well as securing a high level of comprehension and to prepare students to carry out further studies in Basque (Lasagabaster, 2001).

In Model D, all subjects are taught through Basque and Spanish is taught as another subject in the curriculum. The purpose of this model is to reinforce language skills in Basque, converting Basque into an instrument of communication for conversation and enriching language abilities as well as for teaching (Gardner, 2001; Lasagabaster, 2001).

Each of the models are available both in the private and public sectors; and a single school can offer instruction in more than one model. Models A, B and D exist in preschool education and in primary education, whereas in secondary education only models A and D exist (Figure 6).

Besides the differences between the different models, which depend on the main language of instruction, the school network in the BAC is unusual in the way it organizes school ownership. The school network in the BAC can be classified into two main different types, depending on ownership: public schools and Government-dependent private schools. The Basque Government (1987) consolidated the different networks of public schools, private schools and ikastolak[2], into a single network of Basque public schools. Public schools are fully funded by the Basque Government and publicly owned and, therefore, completely free of charge for parents. Government-dependent private schools receive support from the Basque Government as part of their funding. Lastly, there are few fully independent private schools, which are entirely funded by the parents of students enrolled in them.

	Total					Public centres					Private centres				
	Total	Model A	Model B	Model D	Model X	Total	Model A	Model B	Model D	Model X	Total	Model A	Model B	Model D	Model X
Basque Country															
Total	386.583	58.722	68.665	256.909	2.287	201.863	28.715	11.276	161.872	-	184.720	30.007	57.389	95.037	2.287
Infant education	84.327	2.237	13.430	68.244	416	44.183	373	974	42.836	-	40.144	1.864	12.456	25.408	416
Primary education	129.920	4.506	25.910	98.429	1.075	67.416	1.025	3.496	62.895	-	62.504	3.481	22.414	35.534	1.075
Infantprimary special education	494	310	43	141	-	173	44	13	116	-	321	266	30	25	-
Obligatory secondary education (ESO)	86.447	5.736	19.698	60.452	561	40.224	1.420	1.992	36.812	-	46.223	4.316	17.706	23.640	561
Special Education in Secondary	434	176	88	170	-	244	61	30	153	-	190	115	58	17	-
Basic vocational training	4.735	4.378	303	54	-	1.336	1.250	70	16	-	3.399	3.128	233	38	-
Special education task learning	601	328	30	243	-	382	151	-	231	-	219	177	30	12	-
Baccalaureate	31.180	8.990	1.678	20.277	235	14.920	2.502	210	12.208	-	16.260	6.488	1.468	8.069	235
T.T. Intermediate grade	15.309	8.351	3.578	3.380	-	9.586	4.484	2.309	2.793	-	5.723	3.867	1.269	587	-
T.T. Higher grade	22.438	13.012	3.907	5.519	-	12.828	6.834	2.182	3.812	-	9.610	6.178	1.725	1.707	-
Adult education (EPA)(1)	10.698	10.698	-	-	-	10.571	10.571	-	-	-	127	127	-	-	-

Figure 6: Students enrolled in non-university general education in the Basque Country by education level, according to centre ownership and language model Advance data. 2019/20. (EUSTAT, 2019)

[2] Ikastolak means school in Basque. It is a network of schools created during the dictatorship of Franco in the mid-twentieth century in order to support the movement of language and self-identity of the Basque Country, becoming a point of reference for learning the Basque language.

Basic education must guarantee the right to education of all people, so that, from an ethical approach to equality and social justice, education must provide equal opportunities and discriminations of any kind and play a role in compensating for economic, social, cultural and personal differences. The Charter of Fundamental Rights of the European Union (European Parliament, 2000) states in Article 14 that everyone has the right to education, including the possibility of receiving free compulsory education. Act No. 3/2005 of 18 February on Care and Protection of Children and Adolescents (Basque Government, 2005) establishes that all children and adolescents have the right to education and training. Educational training will basically be provided to them in the social and family environment and in educational centres. They also have the right to receive basic education, which includes Primary Education and Compulsory Secondary Education, in the centres that provide the public service of education in the Autonomous Community of the Basque Country. This right is guaranteed by the educational administration, in compliance with the precept of the universal right to education as the owner of public schools, and by the social initiative, owner of private subsidised schools (Basque Government, 2015a).

Basic education must guarantee the right to education of all people, so that, from an ethical approach to equality and social justice, education must provide equal opportunities and discriminations of any kind and play a role in compensating for economic, social, cultural and personal differences. This budget implies that both the Administration and the education officers, as well as the professionals and all the members of the education community, will continue by the principle of inclusion, promoting a comprehensive and personalised education until the end of the basic and compulsory education. In a complementary way, it had to be a challenge for the educational system to achieve the highest possible number of students to reach the level of excellence (Basque Government, 2015a).

Basic education is the stage of education in which new generations must be prepared for adult life, create a solid basis for life-long learning and be able to lead their own lives in a conscious way, choose their own destinies, be responsible for their own choice and integrate into society, engage in an involved, meaningful and responsible way. The aims of education point out, for all people, the goals that make sense of the whole educational process. The aims of basic education are:

- Literacy for the acquisition of the basic elements of culture, integrating a balanced form of all dimensions, from the Basque individual to the universal, and the conscious and integrated use of this knowledge to solve situations and problems in the different areas of life and to create new opportunities for improvement.

- The integral development of the person's dimensions: physical, cognitive, communicative, social, cultural, moral, affective and emotional, aesthetic and spiritual development.
- The preparation for their incorporation into adult life and for being able to live a full life as individual subjects, as active members committed to the development of a harmonic coexistence and to the construction of a fairer and more equitable society and as people committed to the preservation of nature and sustainable development.
- Preparation for entry into further study and/or employment with appropriate guarantees.
- Motivation and preparation for further learning and training throughout their lives.

The goals of basic education are achieved through the core competencies. Basic education will contribute to developing in students the skills that will enable them to achieve the objectives of the general exit profile from Basic Education (Basque Government, 2015a). The general exit profile of the students is defined by the core competencies that the student must achieve by the end of Basic Education in order to achieve the educational goals and to know how to function in the different spheres and situations of life.

The Heziberri 2020 educational model framework (Basque Government, 2015b) develops on the basic competencies approach established in Decree 175/2007, of 16 October (Basque Government, 2007), which establishes the Basic Education curriculum and implements in the Autonomous Community of the Basque Country, in coherence with the framework for European cooperation in education and training (European Commission, 2009), the recommendations of the Report to UNESCO of the International Commission on Education for the 21st Century chaired by Jacques Delors (1996), of DeSeCo/OECD (Rychen & Salganik, 2001) and Tuning (González & Wagenaar, 2003).

2.1.1 CORE COMPETENCES

Competence is the ability to apply in an integrated manner the contents of each community or country education system, in order to ensure the proper implementation of activities and the effective resolution of complex problems (Delors et al., 1996). Basic competences are those which all people need for their personal fulfilment and development, as well as for the promotion of active citizenship, social inclusion and employment (Basque Government, 2015b).

Basic competences definition are based on UNESCO proposal (Delors et al., 1996) and European Union key competences (European Commission, 2006). In the Annex part 8.1 there is a comparison table between different frameworks. Heziberri 2020 (Basque Government, 2015b) distinguishes two types of basic competences: basic transversal competences and basic disciplinary competences (Figure 7).

2.1.2 BASIC TRANSVERSAL COMPETENCES

Basic transversal or generic competences are defined in the curriculum (Basque Government, 2015b): these are the skills needed to solve problems effectively in all areas and situations of life (personal, social, academic and occupational), both in situations related to all disciplines and in situations of daily life. Transversal skills must be promoted and enhanced in working with all areas or subjects and are acquired and applied by integrating them into all areas and situations of life.

The basic transversal competences are:

a) Competence in verbal, non-verbal and digital communications

Using verbal, non-verbal and digital communications in a complementary way to communicate efficiently and adequately in personal, social and academic circumstances.

b) Competence to learn to learn and think

Getting at your disposal study and work habits, learning methods and critical thought, mobilizing and applying what has been learned to other contexts and circumstances, in order to be able to coordinate one's own learning.

c) Competence to live together

Participating in different interpersonal, group and community situations with the criteria of reciprocity, recognizing in the other person the same rights and obligations that are recognized for oneself, contributes to both the personal and the common good.

d) Competence for initiative and entrepreneurship

Display initiative by managing an entrepreneurial process with resolution, reliability and respect for ethical values in various personal, social, academic and work contexts and circumstances in order to turn ideas into acts.

e) Competence to learn how to be

To focus on one's own emotions, thoughts and acts that are generated in various areas and circumstances of life, to reinforce or change them according to their meaning, in order to steer oneself, through continuous improvement, towards the self-realization of the individual in all its dimensions.

2.1.3 BASIC DISCIPLINARY COMPETENCES

Basic disciplinary/interdisciplinary or specific competences are also defined in the curriculum (Basque Government, 2015b): these are the ones needed to effectively solve problems related to life areas and situations (personal, social, academic and occupational), which require the

mobilisation of specific resources related to some of the disciplinary areas. Disciplinary skills have a disciplinary matrix that must be acquired through problem situations that are specific to one of the areas, even though they have a transferable capacity and are multi-functional in that they can be applied to the resolution of problem situations related to several disciplinary areas.

The basic disciplinary competences are:

a) Competence in linguistic and literary communication

To use oral and written texts, in Basque, Spanish and one or more foreign languages, to communicate linguistic diversity in an acceptable, effective and respectful manner, in circumstances that are typical of different areas of life. In the same way, to establish a literary education that allows one to know oneself and the world around us better.

b) Mathematical competence

Apply mathematical knowledge to perceive, define, explain and respond to problems relevant to the needs of life, using modes of thinking, representation and tools of the field.

c) Scientific competence

To use scientific knowledge and methods in a consistent, applicable and accurate manner in the interpretation of natural systems and phenomena, as well as the most applicable scientific and technical applications in various contexts, in order to understand nature from empirical facts and to make informed decisions in all areas and situations of life.

d) Technology competence

Developing and using technological products or systems with requirements, applying, in a systematic and effective way, technical and other information to identify and address problems of concern or to deliver innovative product and services, communicating outcomes in order to continue developing or taking rational decision-making processes.

e) Social and civic competence

To understand oneself, the society in which one is a member and the context in which one lives, through the creation, critical understanding and use in information from the social sciences; as well as through the use of methodologies and procedures unique to them, in order to function independently of one's responsibility as a citizen in everyday situations; in order to participate in the growth of one's life.

f) Artistic competence

Understand and objectively evaluate various cultural and artistic forms, in various contexts of time and usage, in order to be conscious of the role of aesthetic influences in people's and societies' lives. Know the various artistic languages and use their codes in the creation of artistic

messages as a way of expressing oneself and connecting with initiative, imagination and creativity.

g) Motor competence

To face, in an independent, vital, imaginative and articulate way, the various circumstances of the motor sector related to oneself and others, as well as to the physical and cultural environment, incorporating information, procedures and attitudes that lead to the development of motor behaviour, in order to acquire the habits of physical and sport activities that help to the achievement of the integral welfare through a healthy lifestyle.

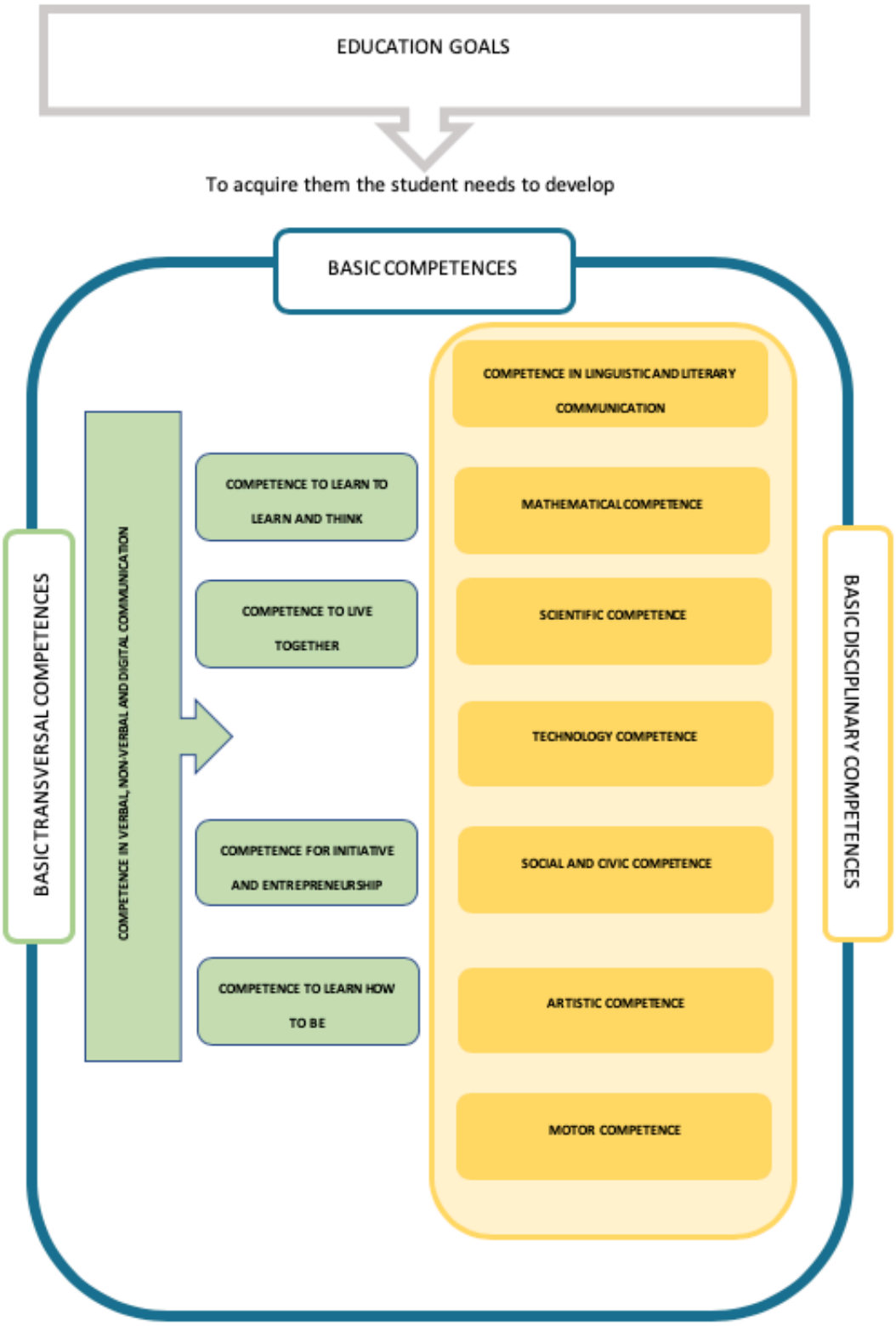


Figure 7: Core Competences resume (Basque Government, 2015b)

2.2 EKI EDUCATIONAL RESOURCE

EKI is an innovative educational resource, which was created in 2013 by the Association of Basque Schools (ABS) along with a publisher called Elkar, with the aim of developing 21st century (European Commission, 2015; World Economic Forum, 2015, 2016) skills. The objectives of the educational resource are to acquire a solid basis for the student to develop fully (as an individual, member of society and part of the local context), whilst acquiring the principles of Basque culture and universal culture; to prepare to continue their studies; to take part in the labour market.

The educational resource has three main axes: the Basque curriculum, 21st century competences and pedagogy of integration (Amezua Monasterio, 2014; Ikaselkar, 2013). One axis of the EKI educational resource is based on the Basque Curriculum (2009), which enables students to learn not only in Basque, but also through Spanish and English. The Basque Curriculum incorporates five basic competences that are meta-disciplinary. These competences include not only the four pillars of education proposed by UNESCO (Delors et al., 1996) – learning to know, learning to do, learning to live together and learning to be- but also a fifth basic competence: learning to communicate.

In order to develop pupils' competences, the EKI educational resource provides four curricular features (Goñi & Altuna, 2019):

- **Axis**: learning and teaching through competences.
- **Contents**: based on features of Basque culture and the official curriculum.
- **Tools**: systematic procedures have been developed for all learning areas to facilitate the competences of learning to do and learning to know.
- **Multilingualism**: an integrated approach to languages with being Basque the main language.

Consequently, the students exit profile needs to be defined in terms of competences. Such basic competences are crucial for life skills and can be meta-disciplinary or specific to disciplines or school-subjects: language and literature; music and dance; arts; physical education, social sciences; mathematics; technology and natural science. Basic competences are developed in all subjects, which is how the EKI educational resource is designed to help students to reach the exit profile and demonstrate the competences that the profile constitutes. The knowledge, abilities and skills, which pupils have to acquire at each level, are specified. Therefore, the whole curriculum of the educational process has been drawn up with the leaving profile in mind.

With respect to the educational resource EKI, Ikaselkar publishers have worked on different combination of formats from the start of the EKI project, using both print and digital formats in eight different school-subjects. These innovative educational resources are available in digital format (Blink) and in print, placing particular emphasis on developing digital skills (Ikaselkar, 2013).

Furthermore, another distinguishing feature is that the resource defines competences and situations as a complete unit. When a competence is defined, it needs to be guaranteed that it is useful or applicable to a real-life situation. Each school-subject has to ensure that its competences are always useful in tackling a real-life situation. A student is said to be competent, when he or she is able to handle a specific situation. This understanding of competence was based by OECD's Definition and Selection of Competences (DeSeCo) project (Rychen & Salganik, 2001), where competences are defined as the ability to meet diverse demands, by drawing on and mobilizing psychosocial resources (including skills and attitudes) in a specific context (Rychen & Salganik, 2001, sec. 4).

As Roegiers (2001) summarized that education based on acquiring (mastering) skills, as opposed to a simple juxtaposition of skills, is important for the implementation of integration pedagogy. The main objective of the pedagogy of integration is to enable student to deal those situations he/she will have to deal with in his/her professional and/or private life.

As far as pedagogy of integration is concerned, pedagogy of integration has four objectives (Gerard, Peyser, & Roegiers, 2006):

- Learning process needs to take place in a meaningful context that makes sense to the student in relation to the real-life situations he/she needs to face in life.
- It is relevant to differentiated things by their relevance, either because it is necessary and practical for daily life, or because it may become the basis for future learning.
- It is important to create real and practical situations related to student particular context.
- Finally, yet importantly, it is essential that the student should be able to associate the learned elements. This fourth objective is based on the close interlinking of the preceding three objectives (process, relevance, and application).

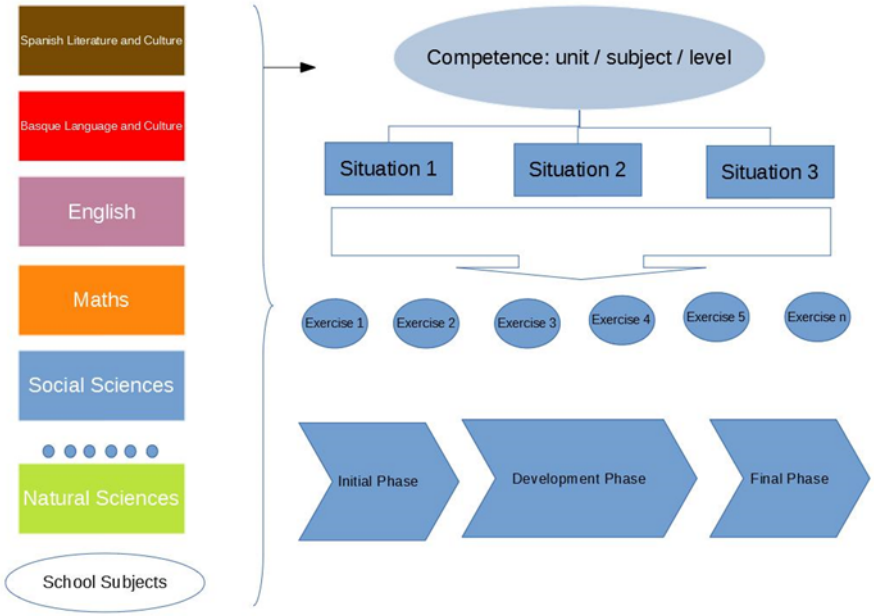


Figure 8: EKI educational resource approach (Garcia, 2021)

According to this definition, EKI suggests 'families of situations'. That is, groups of situations that have a series of common characteristics and that give shape to a competence (Ikaselkar, 2013). Once a competence has been defined, and once that competence has been linked to a family of situations, the teaching unit is created. Each school-subject works on three teaching units (Figure 8), that is to say, three competences, during the school year. The structure of the teaching units is intended to help students to acquire the competences defined for that teaching unit. A teaching unit has three different phases with each activity within them having its own goal and assessment tools. During the development phase of the unit, students should acquire the knowledge needed to confront a situation that may have arisen. After that, students have to use knowledge acquired strategically to carry out a series of tasks in order to tackle the situation successfully. In the final phase of the unit, students should learn to transfer their knowledge to another situation that belongs to the same family of situations. In order for students to prove that they have developed the competence to handle these situations, the teacher's guide offers teachers an assessment dossier with three tasks aimed at solving another situation from the same family. Throughout the process students learn how the knowledge acquired can help them to handle a variety of real-life situations, as Roegiers (2004) stated that the student will consequently be evaluated within a complex scenario. Roegiers (2016) claims the integration of a content area is essential to pedagogy to endow each learner with cognitive, gestural and emotional capability, enabling them to act concretely in complex situations as responsible citizens.

2.3 DIGITAL COMPETENCE DEFINITION PURPOSE

The concept of digital competence has emerged at the same time as technological development and the need for new competences has been acknowledged by society. Development of innovation facilitates and continually generates new practices and priorities, and the value of digital expertise is thus continually evolving and must still be considered in relation to the latest technology and its implementation.

Continuous development of digital competences should be viewed as a continuation from instrumental skills into more active, communicative, analytical and strategic competences. Although the use of laptops, smartphones and the Internet is increasing among almost all groups of people, especially among young people and students, it does not necessarily mean that they develop skills and can benefit from it in the many different aspects of life or just being considered digital natives (Gobel & Kano, 2013). Therefore, high use of technology as such should not be viewed as evidence of digital competence (van Deursen, 2010).

The interpretation of the concept of digital competence is so diverse that there is no standard or internationally agreed meaning. This is triggered, among other factors, by the continuous and rapid advancement of technology that allow and generate new practices and goals. Examples are digital literacy, media literacy, information literacy, etc. They emerged at the same time as technological developments and as a society recognized the need for new competences.

The fact that there are so numerous and varying meanings of the word reflects its significance. It is common that it is no longer a matter of access to and use of technology, but of the desire to make the most of it in practical ways-for life, work and learning.

That is why it is necessary to create a definition of digital competence according to the context, Basque educational context in this case, taking into account its own special features. So, the proposed definition of digital competence in this research is therefore as follows: *digital competence is a mixture of knowledge, skills and attitudes towards the use of technology to perform activities, solve problems, interact, organize and manage information, cooperate and collaborate, and develop and exchange content efficiently, correctly, safely, critically, creatively, independently and ethically*.

2.4 SUMMARY

In this chapter an analysis of Basque educational context has been carried out. The Basque educational context is a complex model and it has its own characteristics, such as, the language model or school models. Along with an enshrined commitment to the objective of promoting the 21st century competences, an educational framework has been established in 2015.

The actual educational framework (Heziberri) distinguishes two types of basic competences: basic transversal and basic disciplinary competences. In the basic transversal competences within which the digital competence is actually defined. As a transversal competence, affects all the rest of transversal competences and also, to the extent that it is a cross-disciplinary competence, will affect all the basic competences of the discipline and must be developed by all. Besides, the digital competence must be integrated into the learning processes of all disciplinary areas/subjects.

To carry out this oversight work, an educational resource has been developed for secondary school stage. The main characteristics of this innovative educational resource has been that is based on competences and pedagogy of integration (Gerard et al., 2006; Roegiers, 2001), as well as it takes into account the development of the digital competence.

As many different digital competence definitions exist, this study makes a scientific contribution making a new definition, taking into account the Basque context and the EKI educational resource.

Chapter 3: Methodology and research design

In this chapter, the methodology and methods of the study are present and discuss. The exploratory design has been used as research method with a descriptive approach. In a first phase a qualitative content analysis research method has been carried out. Using the first method results a quantitative method has been used to analyse the data. A brief introduction to the research process and method is explain in order to situate the thesis within the methodological landscape.

3.1 RESEARCH DESIGN AND METHODOLOGY

Research is the systematic process of collecting and logically analysing data for some purpose (McMillan & Schumacher, 2006). The way in which data is collected and analysed is referred to as the method and describes the tools or techniques used to collect, analyse and interpret data in education research. These methods are used to confirm the knowledge that the researcher has created has reliability and validity (Scott & Morrison, 2006).

As mentioned in the introduction, the exploratory design mixed method has been employed as the methodological approach to the thesis. The purpose of the two-phase exploratory design is that the results of the first (qualitative) method which help to improve or inform the second (quantitative) method (Greene, Caracelli, & Graham, 1989; Leech & Onwuegbuzie, 2009). This design is based on the assumption that an exploration is required for one of many reasons: measurements or methods are not available, variables are uncertain, or there is no guiding framework or theory. Since this design starts qualitatively, it is ideally suited for investigating a phenomenon (Creswell, Plano Clark, Gutmann, & Hanson, 2003).

This design is especially useful for a researcher to generalise the findings to various groups (Morse, 1991), to test aspects of emerging theory or classification (Morgan, 1998), or to investigate a phenomenon in detail and then assess its prevalence. The exploratory design begins with qualitative data, investigates the phenomenon, and then builds on a second, quantitative step. Researchers using this design build on the findings of the qualitative process through the creation of an instrument, the identification of variables or proposals for testing based on an evolving theory or structure. These developments link the initial qualitative process with the subsequent quantitative segment of the analysis.

At the first phase, a qualitative content analysis has been conducted as research method in this thesis. To begin, it is important to describe what content analysis mean. A number of different and nuanced definitions of content analysis are accessible. Berelson (1952) defined content analysis as a research technique for the objective, systematic, and quantitative description of the manifest content of communication. Holsti (1968) says that is any technique for making inferences by systematically and objectively identifying specified characteristics of messages.

Content analysis is also suggested as a method of studying and analysing communication in a systematic, objective, and quantitative manner for the purpose of measuring variables (Kerlinger & Lee, 1986).

Krippendorff (1980) described content analysis as a research technique for making replicable and valid inferences from data to their context, with the purpose of providing knowledge, new insights, a representation of facts and a practical guide to action. As noted by Weber (1990), content analysis is a research methodology that utilizes a set of procedures to make valid inferences from text. In his article, Cole (1988) defines content analysis as a method of analysing written, verbal or visual communication messages. Content analysis was first used as a method for analysing hymns, newspaper and magazine articles, advertisements and political speeches in the 19th century (Harwood & Garry, 2003).

Content analysis can be used as either a qualitative or a quantitative method (Hsieh & Shannon, 2005). Furthermore, it may be used in an inductive or deductive way, being the use determined by the purpose of the study (Elo & Kyngäs, 2008). The inductive approach is recommended if there is not enough former knowledge about the phenomenon or if this knowledge is fragmented (Lauri & Kyngas, 2005). While a deductive approach is based on an earlier theory or model and therefore it moves from the general to specific (Burns & Grove, 2005), an approach based on inductive data moves from the specific to the general (Chinn & Kramer, 1983).

Both inductive and deductive analysis processes have three main phases: preparation, organizing and reporting (Elo & Kyngäs, 2008). While there are no systematic rules for analysing data, the main feature of content analysis is to classified large amount of text into much smaller content categories (Burnard, 1996; Weber, 1990). The preparation phase starts with selecting the unit of analysis (Guthrie et al., 2004). Before selecting the unit of analysis it is important to consider what is going to be analysed in what detail and the sampling considerations (Cavanagh, 1997). The unit of analysis can consist of more that one sentence and can contain more than one meaning. The analysis process could be difficult and challenging if the unit analysis has several meanings (Graneheim & Lundman, 2004). In the same article, Graneheim and Lundman (2004) report that being an analysis unit too narrow may result in fragmentation. In their book, Polit and Beck (2004) suggest that depending on the research question, the unit of analysis can also be a letter, word, sentence, portion of pages or words, the number of participants in discussion or the time used for discussion. Similarly, Robson (2002) declare that researchers are guided by the aim and research question of the study in choosing the contents they analyse.

After choosing the unit of analysis, it is essential that the researcher become completely familiar with the data in order to build theory (Polit & Beck, 2004). After making sense of data, analysis

is conducted using inductive or deductive approach, that means, using qualitative or quantitative content analysis (Kyngas & Vanhanen, 1999).

The aim of the first phase was to know the connections between the EKI educational resource learning activities and the digital competences defined in the exit profile. This phase comprised qualitative document analysis of EKI educational resource. The purpose of the second phase was to zoom out and get more of an overview of how the digital competence exit profile is developed through the learning activities stated in the EKI educational resource. Based on the results of the document analysis in phase one, phase two was designed as a quantitative analysis, where the data was analysed by R software (R Core Team, 2013).

3.2 RESEARCH QUESTIONS

Quantitative content analysis flows from a positivist research tradition and is deductive in its approach as described in previous sections. Its main objective is to test hypotheses, not to develop them (White & Marsh, 2006). The hypotheses of the research were defined as four research questions.

The study is based on the premise that EKI educational resource is an innovative educational resource whereby secondary school students develop digital competence, and that digital competence is considered a cross-curricular competence for secondary school students. For such purpose, the Association of Basque Schools has defined a digital competence exit profile. The overall purpose of the study is therefore to gain knowledge about the relation between the digital competence exit profile defined for Basque secondary school students and the EKI educational resource. The area of research is approached with the following overarching research question:

Does the EKI educational resource embrace all the digital competences defined in the exit profile?

In order to examine this further, the main research question has been operationalized into four sub-question which haven addresses by a quantitative content analysis:

RQ1.- How are the digital competence exit profile areas developed with EKI educational resource?

RQ2.- Are all the digital competences developed with EKI educational resource?

RQ3.- Which are the proficiency levels for each digital competence defined in the exit profile according to EKI learning activities?

RQ4.- What is the relation between the school subject and the development of digital competence?

The first three questions aim to answer if it is enough using the EKI educational resource in order to embrace all the digital competence exit profile. The last question set out to examine if there is any relation between the school subject and the development of digital competence. In other words, if the school subject influence on the development of digital competence of secondary school student.

3.3 PHASES AND PROCEDURE

The researcher who wishes to undertake a study using content analysis must deal with four methodological issues: selection of units of analysis, developing categories, sampling appropriate content, and checking reliability of coding (Stempel & Westley, 1989). When using quantitative content analysis, the focus initially is on the following steps (White & Marsh, 2006):

1. Establish hypothesis or hypotheses
2. Identify appropriate data (text or other communicative material)
3. Determine sampling method and sampling unit
4. Draw sample
5. Establish data collection unit and unit of analysis
6. Establish coding scheme that allows for testing hypothesis
7. Code data
8. Check for reliability of coding and adjust coding process if necessary
9. Analyse coded data, applying appropriate statistical test(s)
10. Write up results

The first step in this process was to establish hypotheses as defined above. Prior to commencing the study, ethical clearance was obtained by the experts of the EKI educational resource. After setting the hypotheses, the educational resource was identified (EKI educational resource) and the sampling method and unit was agreed by the researcher and the supervisor. Once the sampling method and unit has been agreed, the coding scheme was set (see Annex 8.2), in order to test hypotheses. Before that, a sample has been tested to validate the method. Following the validation, the data was coded by the main researcher in a lapse of time, as well as by an external researcher. The main reason to do that was to ensure the validity and reliability of the data.

3.3.1 DETERMINING DATA FOR ANALYSIS

The research questions define the next steps to be taken in the methodology. With that in mind, the next step would be to locate relevant communication content to answer the research question and to determine the time period to be covered (Prasad, 2008). In this research the data is taken from the EKI educational resource, which means, every activity will be analysed in depth.

3.3.2 SAMPLING

Conducting a content analysis requires careful preparation of a corpus of texts for analysis. Prasad (2008) suggests that sampling in content analysis is not so different from sampling in surveys, and thus, depending upon the nature of the communication content, the sampling techniques differ. Researcher must decide to how she break up the corpus into individual units for analysis (unitizing) and how she will draw an appropriate sample of units on which to conduct her analysis (sampling) (Coe & Scacco, 2017). Each learning activity suggested in the EKI educational resource has been taken as unit of analysis. The total units coded are 1663.

As Coe & Scacco (2017) suggest unitizing helps a researcher and the future readers of the research report, to isolate the text or portion of text that is being used in a particular component of the analysis. Krippendorff (1980) distinguishes between three primary types of units: sampling units, recording/coding units, and context units. In this study, the sampling unit has been used as sampling units are the broadest unit (each learning activity of EKI educational resource) and are used to identify what will be included in the analysis (Coe & Scacco, 2017). In the same vein, to identify the sampling units facilitates the collection of a representative corpus of texts, which is said to be a crucial component of a successful content analysis (Coe & Scacco, 2017).

3.3.3 INSTRUMENT

A coding scheme operationalizes concepts that may in themselves be vague (White & Marsh, 2006). The coding process could be done by a computer or by a human. This process entail to follow a set of instructions about what items to look for in a text and then make a notation when the items emerges (Coe & Scacco, 2017). The notation is done based on the established categories, which are relevant and valid. As White and Marsh (2006) suggests relevant means that the categories allow for testing the hypotheses, while validity refers to the degree to which the measurement method reflects the intended, and only the intended, concept (Neuendorf, 2002).

A codebook is created in order to help taking standardize decision during the coding process. Individuals who do coding are called coders and may be the researcher herself/himself or another one (Prasad, 2008). According to Coe and Scacco (Coe & Scacco, 2017), the codebook

defines the categories within the text that the coder will look for, along with a definition descriptive enough to allow the coder (and future researchers who might want to replicate the study or use the same coding scheme) to understand the construct. In the same vein, Prasad (2008) suggest that it is desirable to have more than one coder to independently code the units and to check the inter coder reliabilities. In the present study, not only the main researcher but also the experts of the Basque Association Schools and publishers from Ikaselkar took part on the coding process.

In this study, the researcher has developed a codebook with the kind support of the Basque Association School experts. The instrument developed wants to collect data from EKI educational resource related to the digital competence exit profile. For that purpose of analysis, every learning activity described in the educational resource has been extracted.

The first step in this process was to familiarize with the EKI educational resource. Prior to data collection, the codebook and its categories were defined and agreed between the main researcher and the experts on the EKI educational resource. To establish whether a clear connection between a learning activity proposed in the EKI educational resource with any of the digital competence defined in the exit profile exist, it was essential to understand and have technical expertise in the digital competence framework in which is based the exit profile, the DigComp framework (Ferrari, 2013). The main researcher has participated in future developments of the DigComp framework as independent expert, such as "DigComp 2.1: The Digital Competence Framework for Citizens with eight proficiency levels and examples of use" (Carretero et al., 2017b).

For the purpose of analysis, some codification was carried. The codebook was divided in four sections: learning unit, exercise, digital competence and the level of the digital competence identified (Figure 9).

Learning_Unit	Exercise	Digcomp_competence	Digcomp_level
1.1.3	10	1.1	Foundation

Figure 9: Codebook example

The first step in this process was to code the learning resource material by course level, subject and teaching unit. In order to identify those characteristics, a schema was developed (see Annex 8.2). In the first section or column of the codebook, the teaching unit number is defined. That number identifies the course level, the subject and the teaching unit which makes reference. This can be illustrated briefly by the following explanation.

If in the codebook first column appears **1.1.3**, we can disaggregate the information. The first number **1**.1.3, indicates the course level (first year, in this case). The second number, 1.**1**.3 makes reference to the subject (Basque, in this case). And finally, the last number, 1.1.**3** makes reference to the teaching unit (the third teaching unit of Basque of the first course level is "Ancient news").

There is a feature to be taken into account within the subjects. The social science subject can be taught in several languages: English or Basque. Even though, the material and the exercises are the same, that is, it does not matter the language that is taught, because the exercises will be the same. That is why only the material in Basque has been analysed. Otherwise, the analysis would be duplicated.

The second section indicates the exercise number, whereas the third section makes reference to the digital competence. The last section makes reference to the proficiency level of the digital competence (Foundation, Intermediate, Advanced). One or more digital competence may be developed through an exercise, so each digital competence is coded separately as shown in Figure 10.

Learning_Unit	Exercise	Digcomp_competence	Digcomp_level
1.1.3	35	2.2	Foundation
1.1.3	35	2.4	Foundation

Figure 10: Example of developing more than one digital competence through an exercise

In order to identify which digital competence or competences can be developed through an exercise, dimension 4 of the DigComp framework (Janssen et al., 2013b) was used. Dimension 4 gives examples of the knowledge, skills and attitudes applicable to each competence, even the examples are not differentiated in proficiency levels. Also, the information given in Dimension 3 is important to conclude which proficiency level is attached to each exercise (Table 5).

Table 5: 1.3 digital competence definition by dimensions

Dimension 2	**1.3 Storing and retrieving information**		
Competence title and description	To manipulate and store information and content for easier retrieval, to organise information and data		
Dimension 3	**A Foundation**	**B Intermediate**	**C Advanced**
Proficiency level	I know how to save files and content (e.g. texts, pictures, music, videos, and web pages). I know how to go back to the content I have saved.	I can save, store or tag files, content and information and I have my own storing strategy. I can retrieve and manage the	I can apply different methods and tools to organise files, content, and information. I can deploy a set of strategies

		information and content I have saved or stored.	for retrieving the content I or others have organised and stored.
Dimension 4			
Knowledge examples	Understands how information is stored on different devices/services Can enumerate different storage media Knows different storage options and can select the most appropriate		
Skills examples	Structures and classifies information and content according to a classification scheme/method Organizes information and content Downloads/Uploads and classifies information and content Uses various classification schemes to store and manage resources and information Is able to use information management services, software and applications Is able to retrieve and access previously stored information and content Is able to tag content		
Attitudes examples	Realises benefits and shortfalls of different storage devices/services (online and local storage options) Is aware about the importance of back-ups Acknowledges the importance of having an understandable and pragmatic storage system/scheme Is aware of consequences when storing content as private or as public		

3.3.3.1 EXAMPLE OF INSTRUMENT USE

Let's explain the instrument use with a real example. For this example, we have chosen the exercise 48 of the first learning unit of Basque subject at first school year (1.1.1), as shown in Figure 11.

Learning_Unit	Exercise	Digcomp_competence	Digcomp_level
1.1.1	48	1.3	Foundation

Figure 11: Example of coded exercise

The following exercise has been translated for reader convenience. The original exercise description is on Annex 8.3. The exercise says:

"You will want to exchange information with your new distant friend and, probably, also want to tell your colleagues who you are and how you are.

You will explain verbally to your colleagues who and how it is your partner of exchange: nature, hobbies, tastes...To do this, write a brief description of your friend, even if you do not

know him/her in front, indicate how you represent him according to the information you have received throughout the unit. To perform this work, you can follow the following steps:

- *Before you start, go to the email and retrieve all the information you have received from your exchange partner.*
- *What information have you received?*
- *How will you organize this information?*
- *What characteristics will you choose?*
- *How will you structure the description that you must express orally to be comprehensible by your companions?*
- *Do not forget that you will explain the description verbally. In oral explanations, besides taking care of the words, there are aspects to take into account."*

Reading the exercise is clear to notice that the competence *1.3 Storing and retrieving information* is related to the exercise. The main indicators that make us relate the exercise with the competence are:

- *Before you start, go to the* ***email and retrieve all the information*** *you have* ***received*** *from your exchange partner.*
- *What* ***information*** *have you* ***received****?*
- *How will you* ***organize this information****?*

If we focus on the competence definition, as: *"To manipulate and store information and content for easier retrieval, to organize information and data"*, we are able to match the verbs between the definition and the exercise explanation. Not only the competence needs to be connected, but also the proficiency level of it. In this case, due to the analysis it was decided that the exercise competence level should be foundation.

Foundation proficiency level has been decided taking into the account the definition: *"I know how to save files and content (e.g. texts, pictures, music, videos, and web pages). I know how to go back to the content I have saved"*.

Cambridge University Press (n.d.) defines retrieved as "to find and bring back something". In the exercise instructions, it is explicit that the student needs to retrieve information received from the email and organized it. So, it is clear that in the exercise retrieve means to go back to the information saved. Also, as shown in Table 6, the exercise also gives the instruction about the organization of the information, just as with the competence definition. So, it is deduced that

the exercise has relation with the third competence of information area at foundation proficiency level.

Table 6: Summary of relations between exercise, competence and proficiency level

Exercise instructions	Competence definition	Foundation proficiency level definition
• *Before you start, go to the **email and retrieve all the information** you have **received** from your exchange partner.* • *What **information** have you **received**?* • *How will you **organize this information**?*	*To **manipulate and store information** and **content** for easier **retrieval, to organize information and data***	*I know how to **save files and content** (e.g. texts, pictures, music, videos, and web pages). I know how to **go back to the content** I have **saved***

This analysis has been carried out with all the activities proposed in the EKI educational resource. Needs to be remark that one activity could have relation with one or more digital competence, giving as a result different units coded.

3.4 RESEARCH QUALITY

One of the most important challenges facing research is to make evident that what the researchers say is trustworthy. How can the researchers be sure that the evidence they present to the public is trustworthy? No matter how different the goals of the research, there are certain challenges in common for all researchers, defined as the challenges of enhancing reliability, validity and generalisability (Downe-Wamboldt, 1992; Long & Johnson, 2000). In order to secure the quality of a study, it is crucial issue to consider the reliability and validity of the results.

3.4.1 RELIABILITY

There are two main common definitions or understanding of reliability term. LoBiondo-Wood and Haber (1990) described reliability as the consistency or constancy of a measuring instrument; whereas Polit and Hungler (1989) defined as: the degree of consistency or dependability with which an instrument measures the attribute it is designed to measure. Furthermore, De Vos and Strydom (1998) suggests that an instrument's reliability reflects how well it measures the relevant attribute and how easy it is to replicate the relevant results. Kirk and Miller (1986) define reliability as the degree to which the finding is independent of accidental circumstances of the research (Kirk & Miller, 1986). Others, for example Hammersley (1992) focus more the role of the researcher when he suggests that reliability refers to the degree of consistency with which instances are assigned to the same category by different observers or by the same observer on different occasions (Hammersley, 1992, p. 67).

Reliability is used as a measure of quality and consistency (Scott & Morrison, 2006). Scott and Morrison (2006) advise that the object being measured remain stable in order to ensure reliability. They propose that a measure is reliable if it provides the same results on two or more separate occasions. The assumption is that the object being measured has not changed.

In like manner, Mackey and Gass (2005) reference reliability in its simplest definition refers to consistency, often meaning instrument consistency. Reliability is a necessary, but not enough, condition for content analysis data to be valid (Lacy, Watson, Riffe, & Lovejoy, 2015). Even reliability term is not new issue in content analysis, doubts about what it means and represent, how to report it and the most important issue, what level of reliability is considered acceptable, is not agreed (Feng, 2015; Gwet, 2008; X. Zhao, Liu, & Deng, 2012).

There are two types of reliability: intracoder reliability, which involves a coder's consistency across time, and intercoder reliability, which involves consistency across coders. Lacy et al. (2015) suggest that intracoder reliability could be established when the coding process is run for an extended time period.

Interrater reliability it is a statistical measure of agreement of two or more coders about data. Mackey and Gass (2005) declared that if there is strong reliability, it can be assumed with reasonable confidence that coders are judging the same set of data as representing the same phenomenon.

Notwithstanding above, intrarater reliability is similar, but considers one researcher's assessment of data. Mackey and Gass (2005) defined it as an attempting to ensure that the researcher would judge the data the same way at different times. They define the process as: firstly, the researcher codes all the data. Then, after some lapse of time (few weeks or months) the researcher would need to re-coded the data or some part of it. Similar to interrater reliability,

if the result is high, then the researcher can be confident in his/her own consistency. In the research carried out, the main researcher re-code the data after one month, with 99% of the data being identical (1685 units coded).

In this thesis, the researcher has developed a list of coding categories from the theory on digital competence exit profile for secondary school students (Ikaselkar, 2015) based on European digital competence framework (Ferrari, 2013). These categories were discussed with both the principal supervisor and the people in response of the educational resource EKI before the initial coding started. During the coding and analysing of data the team discussed extracts from the educational resource. When analysing the educational resource, some extracts (learning activities) were discussed in detail, and coding categories were redefined several times before ending up with the final four coding categories presented above (educational resource subject-level, learning activity number, digital competence category and digital competence level).

During all the research peer debriefing was also used. Creswell and Miller define peer debriefing as reviewing the data and research process by someone who is familiar with the study or the topic being studied. The peer reviewer helps, plays the devil's advocate, critiques the researchers' conclusions, drives researchers to the next level methodologically, and raises critical questions about methodology and interpretations (Creswell & Miller, 2000, p. 129).

Furthermore, Robson (1993, p. 404) describes peer debriefing as exploring the findings and conclusions of a colleague or other expert on a continuous basis. He believes that being explicit when presenting to a peer the research fosters subsequent credibility. Similarly, Holloway and Wheeler (1996, p. 165) remark that supervisors have a key role with research students to ensure rigour in their studies. Likewise, Long and Johnson (2000) suggest that peer debriefing may be pursued in numerous forms: one of them is to analyse new studies at intervals with experienced colleagues, the second to present and support approaches and observations at national research conferences, and the third to present results and effects to concerned audiences (Long & Johnson, 2000).

However, one of the reliability problems to be addressed in this context is that the analysis would yield the same or similar results if it were carried out in the same way by another researcher or at different times (Kirk & Miller, 1986). Following Silverman's (2011) suggestion, the intercoder reliability approach was used to maintain high reliability during the qualitative process of the analysis.

Intercoder reliability, also referred to as intercoder checks or intercoder agreement (Creswell, 2017) was used in the research. In the first phase, I developed a list of coding categories from theory of digital competence (Ferrari, 2013). These categories were discussed with the supervisor before the coding process started, during coding and analysis of data were discussed.

While reviewing the coded data, extracts from the educational resources were analysed in depth, and the coding categories were redefined several times until the final four coding categories (learning unit, exercise, digital competence, proficiency level) were settled.

Because coding means making decisions on how to classify or categorize particular sets of data, if the study uses only one coder and no intracoder reliability measures are reported, the reader's confidence in the findings of the study may be undermined. In order to increase trust, it is important not only to have more than one data rater code wherever possible. When 100% of the data can be encoded by two or more individuals, the confidence of readers in the reliability of the encoding categories would be increased, assuming that the reliability scores are high. Nevertheless, researchers should also understand the complexity of the coding scheme when deciding how much data should be coded by a second rater. With highly objective, low-inference coding schemes, it is possible to develop confidence in the reliability of the rater with as little as 10% of the data (Mackey & Gass, 2005).

After the two revisions and coding process done by the principal researcher, the number of units identified were 1685. Before the second rater or external researcher start analysing the data, the main researcher explained the logic and process of coding. The second external rater has encoded the 100% of the data, having identified 1793 units. That is not enough to know the agreement between the encoders, so data comparison analysis was carried out.

The comparison was carried out with R software (R Core Team, 2013). Two different functions were used in order to assure the data comparison. On the one hand, “inner_join ()” function was used. The inner_join function return all rows from x where there are matching values in y, and all columns from x and y. If there are multiple matches between x and y, all combination of the matches are returned. In the other hand, “semi_join()” function was used to ensure the comparison was reliable. The semi_join function return all rows from x where there are matching values in y, keeping just columns from x. A semi join differs from an inner join because an inner join will return one row of x for each matching row of y, where a semi join will never duplicate rows of x.

After using both techniques mentioned before, 1663 units were accepted, as a result of being equal in both researcher’s analysis, whereas 152 units were rejected. So, the final data used for analysis is based on 1663 units (Figure 12).

There are no hard and fast rules on the degree of agreement required to use a collection of ratings to make high-level decisions or to find the assessment process to be reliable. In general, researchers claim that the greater the importance of the evaluation, the greater the need for high inter-rate agreement (LeBreton & Senter, 2008; Nunnally, 1994). While there are many methods to measure interrater reliability, a simple percentage is one of the easiest ways to calculate

interrater reliability. It is the ratio of all coding agreements to the total number of coding decisions made by coders. If the percentage of absolute agreement is used, the values from 75% to 90% indicate an acceptable degree of agreement (Hartmann, 1977; Stemler, 2004).

The analyses show that the degree of agreement between the two researchers is 93%. Thus, there is reason to assume that the results are acceptable and reliable. In this research the principal supervisor served the role as a peer reviewer throughout the entire study, providing feedback to all the different stages of the research process and in this way contributing to strengthening the reliability of the study.

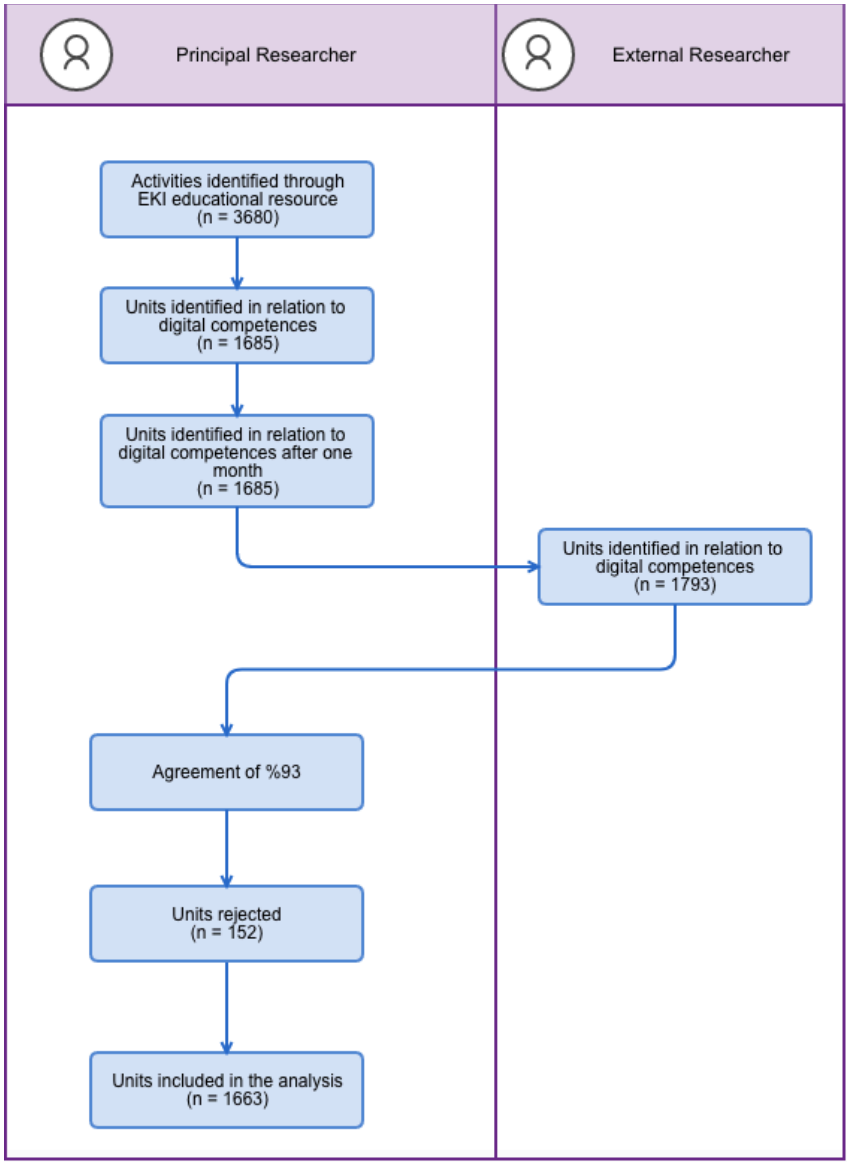


Figure 12: Reliability process diagram (Garcia, 2021)

3.4.2 VALIDITY

In quantitative terms, validity defines whether the research truly measures what it was intended to measure or how truthful results are (LoBiondo-Wood & Haber, 2010, p. 561) or validity meaning is measured by the degree to which an instrument measures what it is intended to measure (Polit & Beck, 2004). The process of validation is not something inherent to the study; it is an issue that interferes with the entire research process (Brinkmann & Kvale, 2015; Yin, 2014). In order to establish the quality throughout the research process, four types of validity test can be distinguished: construct validity, internal validity, reliability and external validity (Yin, 2014).

Construct validity is a judgement about the extent to which interventions and measured variables actually covers the concepts being studied; while internal validity focuses on the viability of causal links between the independent and dependent variables. In contrast, external validity, examines if and to what extent, findings can be generalised to other people and locations (McMillan & Schumacher, 2006). Furthermore, reliability is related to the operations of the study and whether these can be repeated by a different person or at a different time and return the same results.

The first type of validity, construct validity, seeks to establish whether the correct operational measures have been used for studying the concepts under study. In this research the whole educational resource of secondary level were analysed by means of qualitative content analysis (Krippendorff, 1980). Secondary school students' digital competence was in this study operationalised through four theoretically interrelated concepts: educational resource subject-level, learning activity number, digital competence category and digital competence level. Those concepts were developed on the basis of secondary school students' digital competence exit profile and the educational resource EKI.

Lincoln and Guba (1985) defined that internal validity as being the credibility, believability or plausibility of the research findings and results. Highly potential treat to internal validity arise primarily during the analysis of a study, and are caused by for instance experimental procedures treatments, or experiences of the participants that threaten the researcher's ability to draw correct inferences from the data about the population in an experiment (Creswell, 2017, p. 162). Accordingly, to strengthen the internal validity an interrater reliability method was implemented. An interrater reliability, is an attempt to ensure that the investigator would judge the data at various time periods in the same manner (Mackey & Gass, 2005). In this research, the interrater reliability was 99%, so it could be considered as highly reliable data.

3.5 SUMMARY

The research design consisted of two phases. Phase one was based on the analysis of the EKI educational resource and the exit profile. Also, an external researcher encoded the data to validate the data analysis and make it reliable. Employing this technique, a depth data comparison was done to collect the final quantitative data. In this chapter the process of collecting data and subsequent analysis process has been defined and explained. Chapter three is completed by detailing how the rigour has been maintained during the research process and ensured the reliability and validity of the data collected. In the following chapter, a detailed analysis of research findings is presented.

Chapter 4: Research results

In this chapter, the research study results are presented. From research question 1 to 3 a descriptive analysis is done. The quantitative findings are presented for digital competence exit profile areas developed with EKI educational resource (Section 4.1), for development of digital competences (Section 4.2), for the proficiency levels for each digital competence defined in the exit profile (Section 4.3) and finally, results are shown for the relation between the school subject and the development of digital competence (Section 4.4) due to a correlation analysis. Finally, a short summary (Section 4.5) closes the chapter.

All analyses were completed in R v.4.0.1 (R Core Team, 2013) and RStudio (RStudio Team, 2015). All data figures were made with the ggplot2 package (Wickham, 2016).

4.1 THE DEVELOPMENT OF DIGITAL COMPETENCE EXIT PROFILE AREAS THROUGH EKI EDUCATIONAL RESOURCE (RQ1)

The aim of this section is to identify the amount of relationships between the activities suggested by the EKI educational resource that makes reference to any of the digital competence area. 1663 references were identified in total, which means, that one activity could make reference for one or more digital competence. So, it needs to be taken into account, that there are not 1663 activities, but rather the amount of linked activities with digital competence.

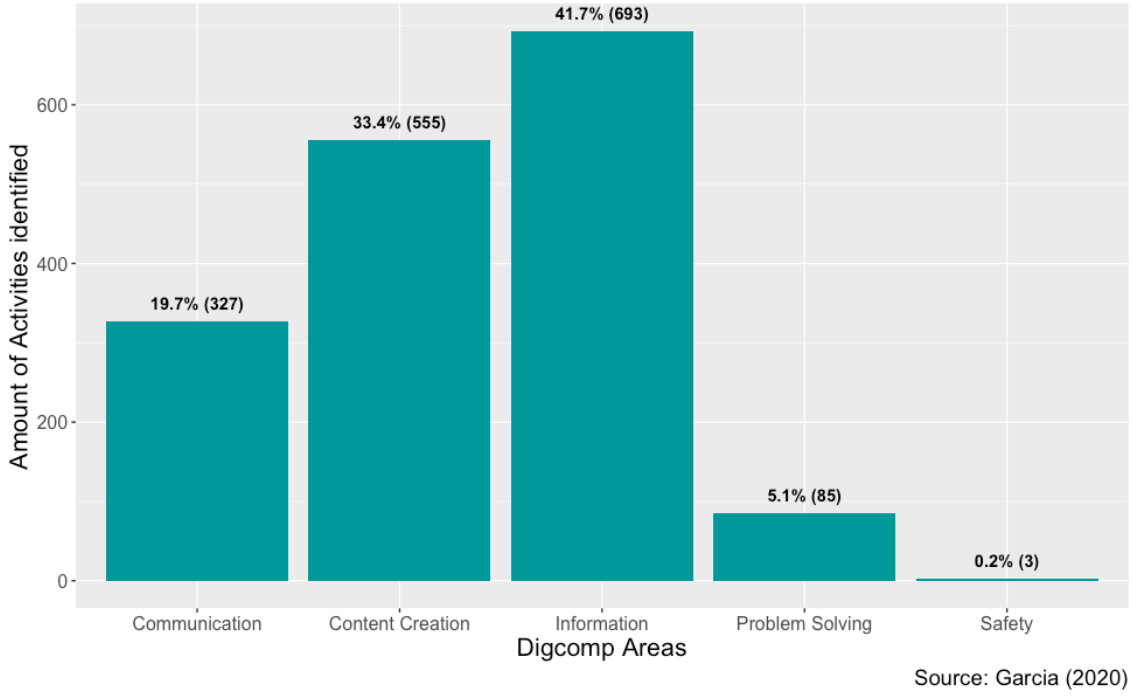


Figure 13: Activities references per DigComp Area

Figure 13 shows that there is a slight larger difference between the development of the exit profile digital competence areas. While information (42%), content creation (33%) and communication (20%) competences areas are developed in a significance way, problem solving (5%) and more precisely safety (0.1%) are hardly developed.

Figure 13 provides the summary statistics for the amount of references about digital competences identified in the EKI educational resource. Further analysis showed that information area is highly developed, as 693 references are observed. Similarly, content creation area with 555 observations and communication area with 327 observations are the most commonly developed areas. In contrast, activities which makes reference to problem solving area digital competences are only 85, while the safety activities are just 3.

What is striking about the figure above (Figure 13) and to emerge from the data is that the safety area development is marginal. This makes us think that the safety area is not taken into account in the EKI educational resource design process. Also, we can assume that the digital competence exit profile is not developed entirely. Nevertheless, this data is not enough to know if all the competencies established in the exit profile are really developed according to their level of proficiency.

4.2 THE DEVELOPMENT OF COMPETENCES WITH EKI EDUCATIONAL RESOURCE (RQ2)

The aim of this section is to identify the amount of relationships between the activities suggested by the EKI educational resource that makes reference to any of the digital competence defined in the exit profile.

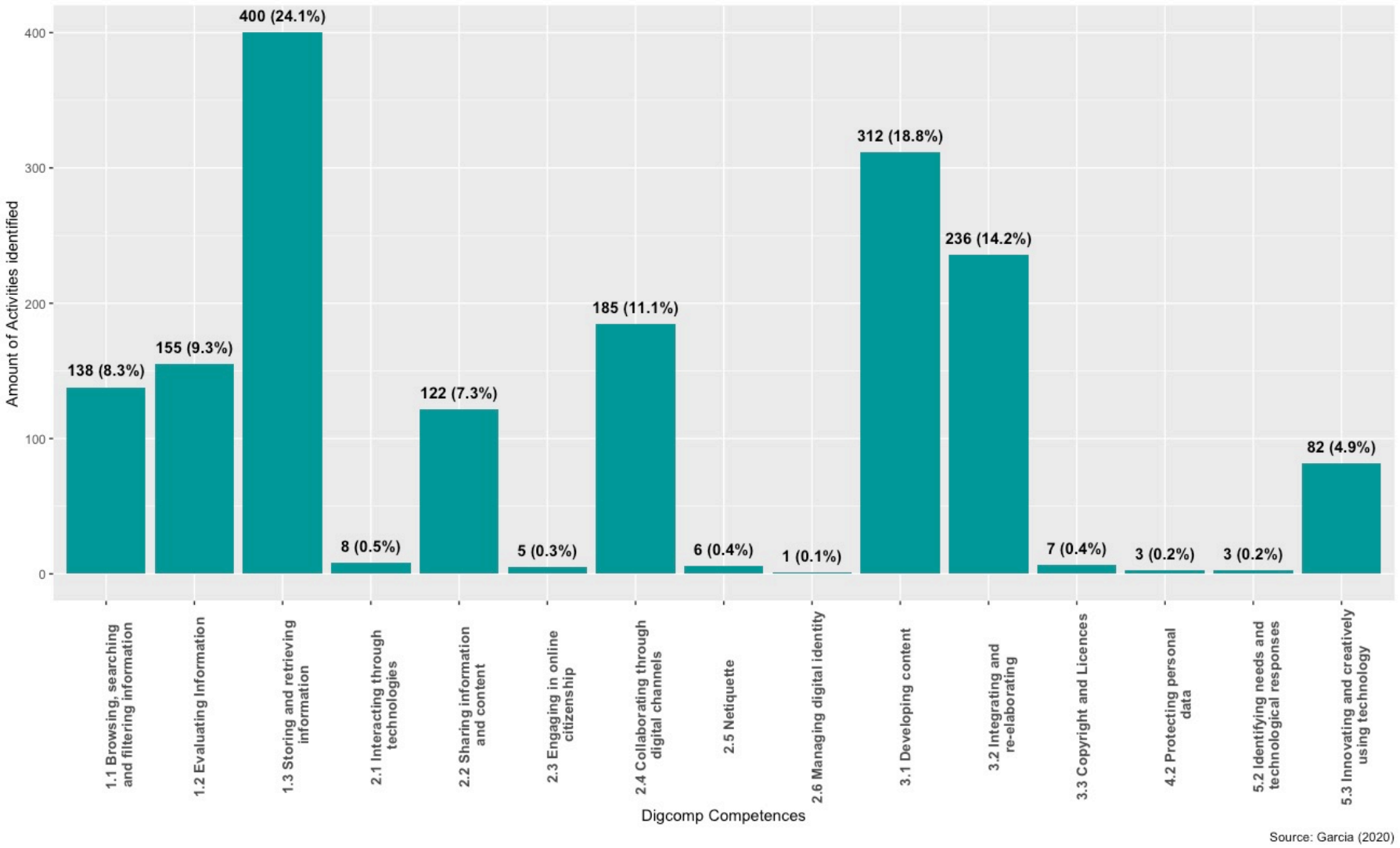


Figure 14: Activities references per DigComp Competence

Figure 14 provides an overview of the amount of activities observed classified by digital competences of the exit profile. This figure (Figure 14) is quite revealing in several ways. First, unlike the previous figure (Figure 13) where the observations are clustered by digital competence area, this figure Figure 14 helps to visualize more concisely the observations by competence.

On the one hand, taking into account the digital competences clustered on information area, there is a significant difference between competences observed. The competence defined as storing and retrieving information (1.3), has 400 observations, while the competences defined as browsing, searching and filtering information (1.1) and evaluating information (1.2), have only 138 and 155 observations, respectively.

Furthermore, there is a substantial difference between the competences related to communication area. While sharing information and content (2.2) and collaborating through digital channels (2.4) competences has the major observations, 122 and 185 each. The rest of the competencies (2.1, 2.3, 2.5 and 2.6) only add up to 1.3% of the total observations made, being 20 observations in total.

Additionally, similar to what happens to the competences in the information area, competencies clustered in content creation area are those with high observation rate, even there are some differences between competencies. Both developing contents (3.1) and integrating and re-elaborating (3.2) competences share a high number of observations, 312 and 236 observations. By contrast, copyright and licenses (3.3) competence is slightly developed. The 3.4 competence, programming, is remarkable because there is not observation related to it. Surprisingly, another competence defined in the exit profile is not developed at any point in the EKI educational resource.

Moreover, in Figure 13 an unexpected result come out. Safety area competences are not identified in all the EKI educational resource units. Only 3 observations were detected which makes reference to protecting data and digital identity (4.2 competence). Similarly, problem solving area competences are not significantly developed in the EKI educational resource. To distinguish between the two competences of problem-solving area identified, the competence defined as identifying needs and technological responses (5.2) only represents the 0.18% of the total amount of identified observation, just 3 observations in total. Although the competence 5.3 could seem to be develop in depth, only the 4.93% of the total observations make reference to that competence. In total, 82 observations have relation with the competence named as innovating and creatively using technology.

From this it can be deduced, on the one hand, that even in Figure 13 the digital competence areas are developed, not all the competences of each area are developed in the same way. On the

other hand, the lack of development of safety (0,1%) and problem solving (5%) areas is concluded.

4.3 THE PROFICIENCY LEVELS FOR EACH DIGITAL COMPETENCE DEFINED IN THE EXIT PROFILE ACCORDING TO EKI LEARNING ACTIVITIES (RQ3)

The aim of this section is to identify the amount of relationships between the activities suggested by the EKI educational resource that makes reference to any of the digital competence area and its proficiency level defined in the exit profile.

4.3.1 INFORMATION AREA

The figure below (Figure 15) shows some of the main characteristics of the information area digital competences. It is apparent from this figure that most of the activities are related to intermediate level achievement. Nevertheless, this result is somewhat counterintuitive.

If we focus more in depth in the exit profile, we could figure out that the minimum levels required for each competence are not reached. From the data in Table 7 and Figure 15, it is apparent that the competences *1.1 Browsing, searching and filtering information* and *1.2 Evaluating information* do not accomplish the minimum proficiency levels defined in the exit profile. That means, that are not enough activities which could help students to achieve the adequate proficiency levels. As Table 7 and Figure 15 shows, few activities are raised in the EKI educational resource which helps to develop the advance proficiency level in the first two competence of information area.

Notwithstanding the foregoing, the competence *1.3 Storing and retrieving information* shows to have enough activities in order to gain the minimum proficiency level, which is set out in intermediate. So, the most striking result to emerge from the data is that just one of the competences of information area is expected to be developed with the EKI educational resource.

Table 7: Information area digital competences

Information Area		
1.1 Browsing searching and filtering information	1.2 Evaluation information	1.3 Storing and retrieving information
Advanced	Advanced	Intermediate

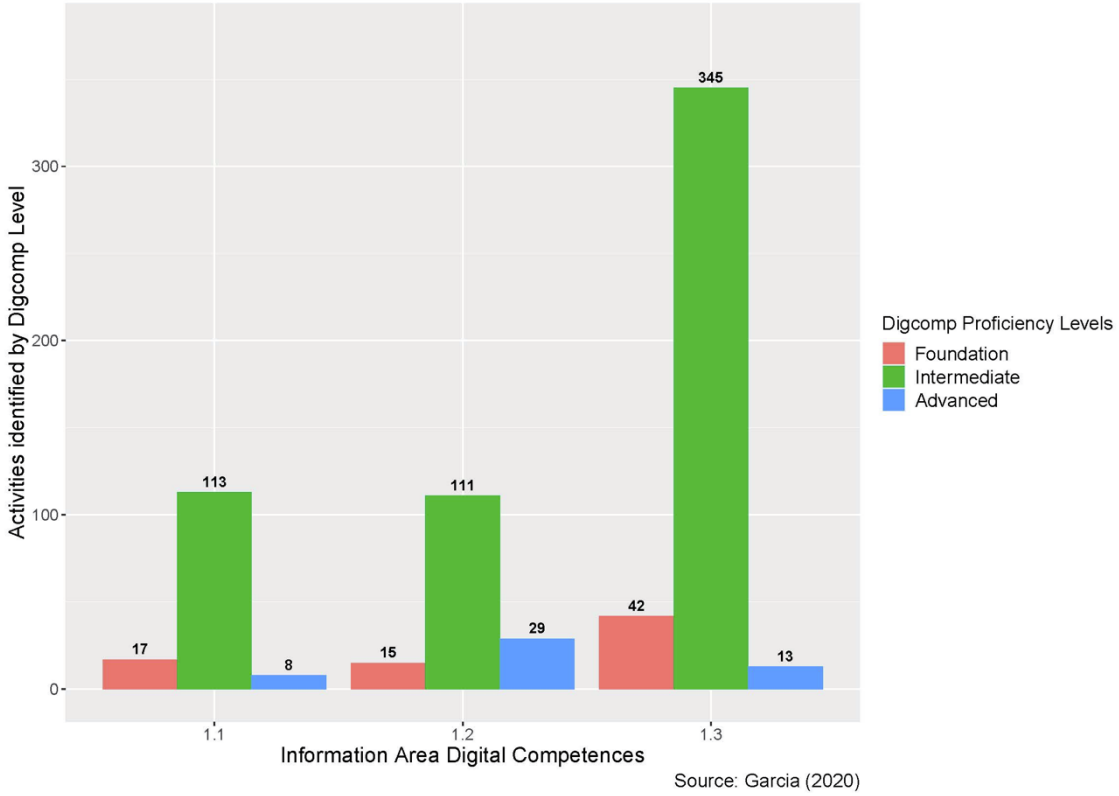


Figure 15: Information area activities identified per proficiency level

4.3.2 COMMUNICATION AREA

The table below (Table 8) shows some of the main characteristics of the communication area digital competences. As can be seen from the Figure 16, just two competences reported significantly more activities than the other competences.

Table 8: Communication area digital competences

Communication Area					
2.1 Interacting through technologies	2.2 Sharing information and content	2.3 Engaging in online citizenship	2.4 Collaborating through digital channels	2.5 Netquette	2.6 Managing digital identity
Advanced	Intermediate	Foundation	Advanced	Intermediate	Intermediate

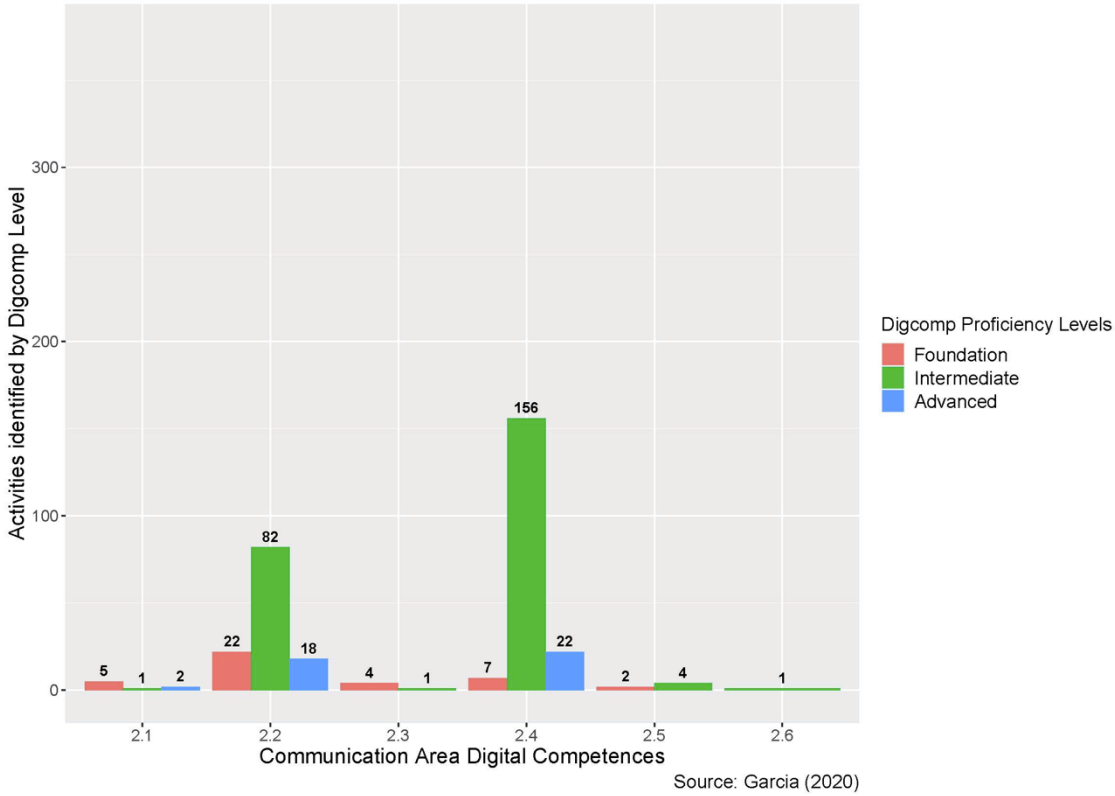


Figure 16: Communication area activities identified per proficiency level

We can divide the competences in two groups: those that have activities related with all digital competence proficiency levels and the ones that have two or less.

On the one hand, we will focus on the following competences: *2.3 Engaging in online citizenship*, *2.5 Netiquette* and *2.6 Managing digital identity*. As shown on Table 8 and Figure 16, we could determine that the competences mentioned before are developed as estimated in the exit profile. However, with a closer inspection of the Table 9, we could assume that there are not enough activities in order to confirm that those competences are developed entirely. Table 9 shows the amount of activities by digital competence and proficiency level. A depth analysis of other competences can be found in Annex 8.4.

Table 9: Amount of activities identified by competences and proficiency level (Communication Area)

Proficiency level / Competences	Foundation	Intermediate	Advanced
2.1	5	1	2
2.2	22	82	18
2.3	4	1	0
2.4	7	156	22
2.5	2	4	0
2.6	0	1	0

Although Figure 16 shows that the competence 2.3 Engaging in online citizenship most activities are related to foundation proficiency level, Table 9 clearly reveal that only there are four activities identified which the proficiency level mentioned. If we take into account that the material is used during all the secondary school period (that means, four years at least), it is a poor amount of activities in order to develop the competence properly.

Similarly, Table 9 provides information about competence defined as *2.5 Netiquette*. Just six activities (4 related to intermediate proficiency level and 2 related to foundation proficiency level). The amount of activities results not to be significant to develop such competence. What is striking about the results of Table 9, is the competence named as *2.6 Managing digital identity* which only has one identified activity. This is a remarkable outcome, as it can be considered as inexistent developed competence through EKI educational resource.

On the other hand, we will focus on competences defined as 2.1 Interacting through technologies, 2.2 Sharing information and content and 2.4 Collaborating through digital technologies. If we focus on the amount of activities for 2.1 competence in Table 9, it is apparent from that table that very few activities were identified with that competence (5 foundation proficiency level, 1 intermediate proficiency level, 2 advanced proficiency level). So, we can conclude that *2.1 Interacting through technologies* competence is not developed at the defined level in the exit profile (advanced), as there are not enough activities suggested nor identified in the EKI educational resource.

Furthermore, as shown in Table 8, the competence 2.4 should achieve the advanced proficiency level, but Figure 16 presents clearly that most of the activities identified are attached to intermediate proficiency level. As a result, we can assume that with the EKI educational resource the goal of achieving the advanced proficiency level in that competence is not accomplish. Nevertheless, a possibility could be to redefine the proficiency level, as it could be possible to achieve the intermediate proficiency level, with 156 activities identified in relation with intermediate proficiency level, for such competence.

Finally, Figure 16 illustrates the results obtained in the research related to the communication area. Interestingly, the competence *2.2 Sharing information and content* is the only competence from communication area which can be considered to be developed through EKI educational resource at its respective proficiency level (intermediate) (Table 8). There are many activities which makes reference to different proficiency level, as shown in Table 9 (22 foundation, 82 intermediate and 18 advanced proficiency level). A depth analysis of other digital competences activities by school year and proficiency level can be found in Annex 8.5.

Table 10: 2.2 Sharing information and content digital competence activities by school year and proficiency level

School Year / Proficiency Level	1st Year	2nd Year	3rd Year	4th Year	Total
Foundation	15	5	1	1	22
Intermediate	14	18	38	12	82
Advanced	1	4	6	7	18
Total	30	27	45	20	122

Table 10 presents a summary of the activities of *2.2 Sharing information and content* classified by school year and proficiency level. Table 10 allows to identify a progression during the school years and how those activities have different proficiency levels in each school year. The exit profile (Table 8) defines for 2.2 competence an intermediate proficiency level. The results, as shown in Table 10, indicate that during the first and second school year foundation and intermediate proficiency level activities are developed through EKI educational resource, whereas the third and fourth year intermediate ones are predominant, allowing students to achieve the proficiency level defined in the exit profile.

4.3.3 CONTENT CREATION AREA

The table below (Table 11) provides the summary of the main characteristics of the content creation area digital competences. Figure 17 provides the summary of the activities identified in the research grouped by proficiency levels. The most striking result to emerge from the data is that the competence *3.4 Programming* is not being identified. As a result, it means that this competence does not appear all over the four school years in the EKI educational resource.

Table 11: Content creation area digital competences

Content Creation			
3.1 Developing content	3.2 Integrating and re-elaborating	3.3 Copyright and Licenses	3.4 Programming
Advanced	Advanced	Intermediate	Intermediate

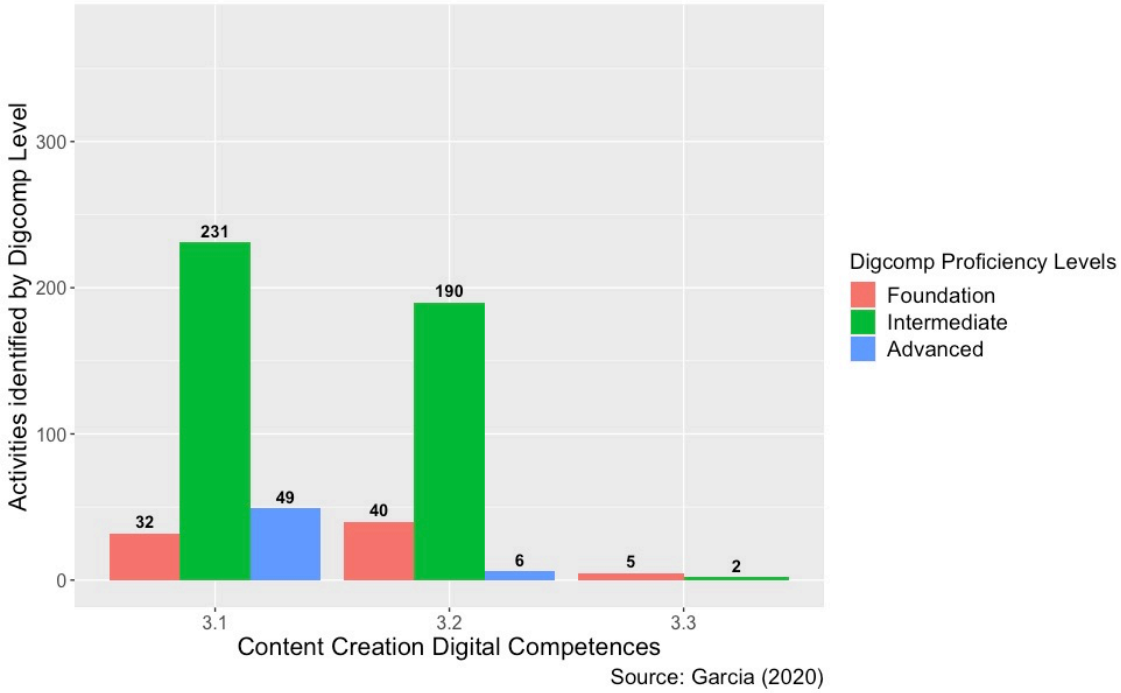


Figure 17: Content creation area activities identified per proficiency level

It is apparent from this table (Figure 17) that very few activities were identified related to the competence *3.3 Copyright and Licenses* (just seven activities at all) if we compare it to the other two competences: *3.1 Developing content* and *3.2 Integrating and re-elaborating*. From the chart, it can be seen that by far that the predominant activities are those related to intermediate proficiency level. However, it is not enough to know whether the exit profile is actually being achieved in this area.

As can be seen in Figure 17 and Table 11 (above), it can be concluded that none of the competences of content creation area reach to the minimum level established in the exit profile.

Table 12: Amount of activities identified by competences and proficiency level (Content Creation Area)

Proficiency level / Competences	Foundation	Intermediate	Advanced	TOTAL
3.1	32	231	49	312
3.2	40	190	6	236
3.3	5	2	0	7
3.4	0	0	0	0
TOTAL	77	423	55	555

The table above (Table 12) indicates the activities identified in the research classified by proficiency level. As mentioned before, the competence *3.3 Copyright and Licences* just have five foundation proficiency level activities and two intermediates. It can be concluded that this competence is not developed during the secondary school period.

Focusing on the competence *3.2 Integrating and elaborating*, it is clear that the intermediate proficiency level activities are majority in the EKI educational resource. Although there are some activities of advance proficiency level (just six) and the exit profile defines the advanced level as the goal to be achieved, it can be reckoned that the amount of activities is not enough to achieve the goal established.

Table 13: 3.1 Developing content digital competence activities by school year and proficiency level

School Year / Proficiency Level	1st Year	2nd Year	3rd Year	4th Year	Total
Foundation	22	7	3	0	32
Intermediate	45	60	42	84	231
Advanced	0	8	32	9	49
Total	67	75	77	93	312

Table 13 provides the results obtained from the analysis of the research. It shows the relation between the identified activities proficiency level and the school year of the *3.1 Developing content* competence. From the table, it can be seen that by far the most outlined proficiency level activity is intermediate. However, the exit profile defined advanced proficiency level as the minimum level each student should achieve at the end of the secondary school. It is supposed that advanced proficiency level activities should hold sway during the last years, but the study reveal that does not happen with *3.1 Developing content competence*.

4.3.4 SAFETY AREA

Turning now to safety area analysis, there are surprising and unexpected results. The single most striking observation to emerge from the data analysis is that just one out of four competences were identified through the EKI educational resource activities as shown in Figure 18. Only three activities were identified for 4.2 Protecting data and digital identity. Safety area appeared to be unaffected by the EKI educational resource, as only trace amounts of activities were detected in the analysis and all of them are in the second school year.

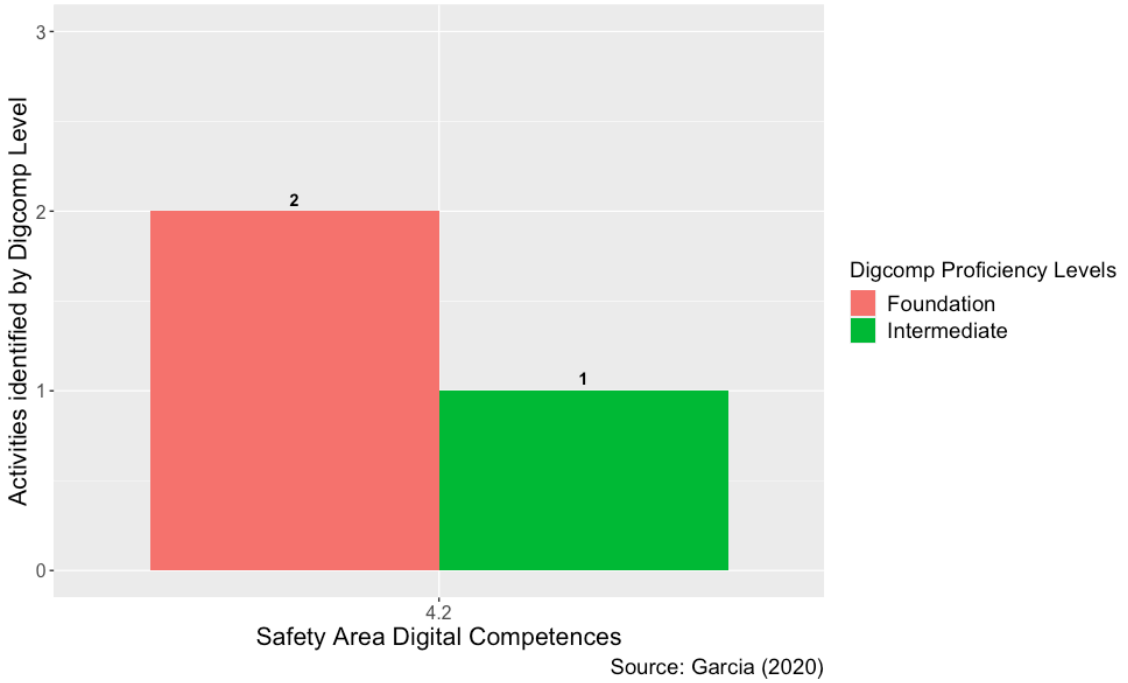


Figure 18: Safety area activities identified per proficiency level

4.3.5 PROBLEM SOLVING AREA

The next area of analysis was concerned with problem solving. The figure below (Figure 19) illustrates the main characteristics of the activities identified in the analysis. It is apparent from this figure that only two competences (*5.2 Identifying needs and technological responses* and *5.3 Innovating and creatively using technology*) were developed. There was no evidence that the 5.2 competence has an influence on EKI educational resource, as only three activities were identified.

Nonetheless, the *5.3 Innovating and creatively using technology* competence seems to be developed in the educational resource, more specifically in Maths subject (50 activities identified). At first sight, it seemed that the with the activities found in the educational resource, it is possible to get the minimum level defined in the exit profile as showed in Table 14. Withal, it is precise to be more concrete in the analysis of the results of the competence, in order to achieve a satisfactory conclusion.

Table 14: Problem solving area digital competences

Problem Solving			
5.1 Solving technical problems	5.2 Identifying needs and technological responses	5.3 Innovating and creatively using technology	5.4 Identifying digital competence gaps
Intermediate	Intermediate	Intermediate	Intermediate

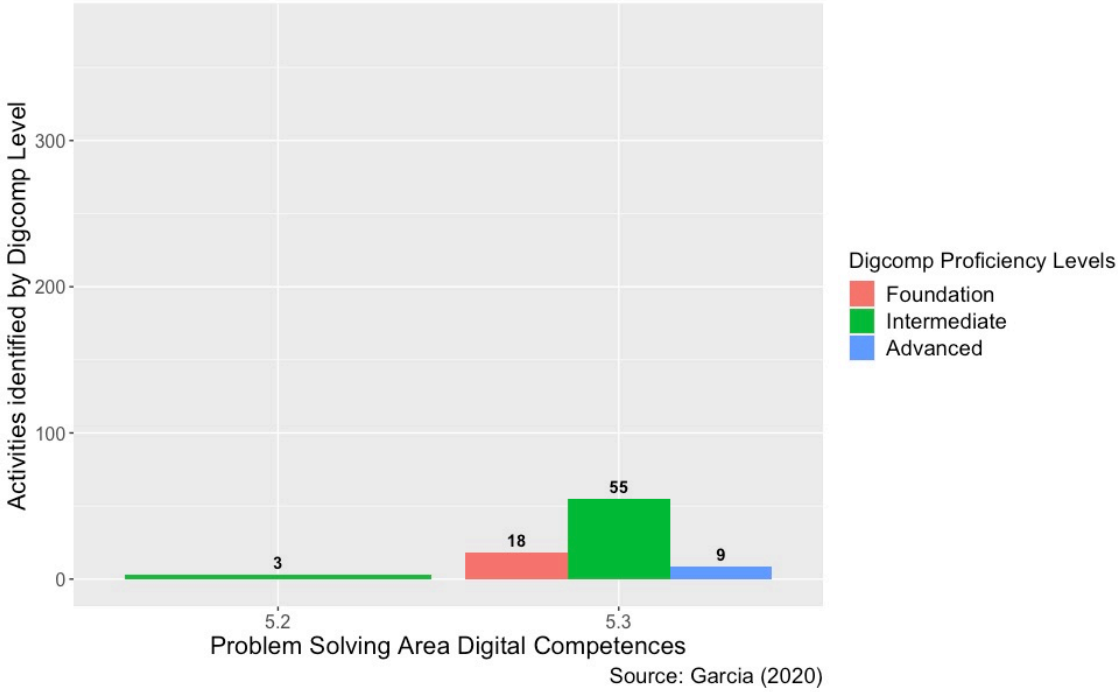


Figure 19: Problem solving area activities identified per proficiency level

Table 15 shows the number of activities identified for the competence defined as *5.3 Innovating and creatively using technology* by proficiency level and school year of each activity. It can be seen from the data in Table 15 that during the all the secondary school, intermediate proficiency level activities are prevailing. While the first two years the amount of activities identified, independently of the proficiency level, is 28, the amount activities for the last year only is 37. To be more precisely, 55 activities of intermediate proficiency level have been identified out of a total of 82, the 67% of the total.

Table 15: 5.3 Innovating and creatively using technology

School Year / Proficiency Level	1st Year	2nd Year	3rd Year	4th Year	Total
Foundation	5	0	0	13	18
Intermediate	10	7	14	24	55
Advanced	0	6	3	0	9
Total	15	13	17	37	82

4.4 RELATION BETWEEN THE SCHOOL SUBJECT AND THE DEVELOPMENT OF DIGITAL COMPETENCE (RQ4)

Turning now to the relation about the subjects and the digital competence areas, the content analysis done helps to clarify if subject has any influence or relation with digital competence area development.

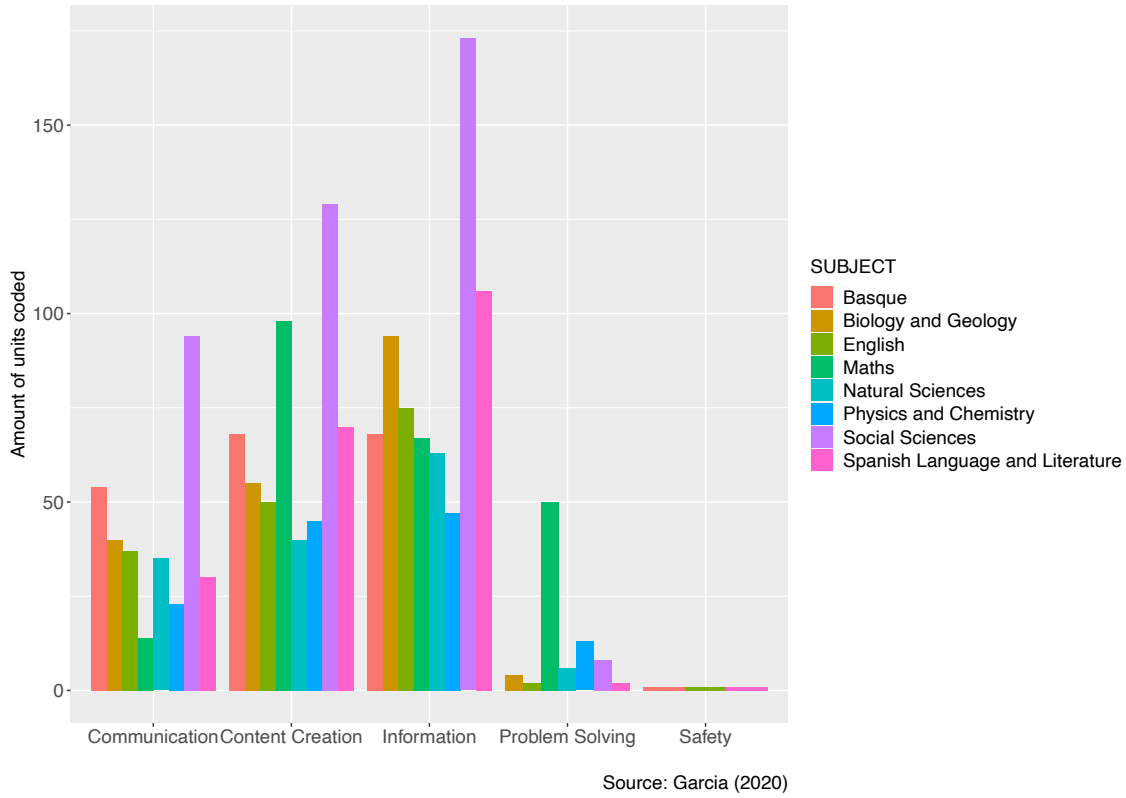


Figure 20: Amount of school subject coded units by DigComp area

While information (42%), content creation (33%) and communication (20%) areas are the ones that concentrates the majority of activities coded, problem solving (5%) and safety (0.18%) are the least developed. Nevertheless, focusing on school subjects, we can stress remark that social science activities (24.3%) are the ones that ease the development of the most developed digital competence areas as shown in Figure 13. However, analysing the cluster of Figure 20 is not enough to conclude if there is any relation between the school subject and the digital competence area development.

Having considered the results of another research questions, now we need to move to analysed if really there is any relation between the development of the digital competence areas and subjects. In order to answer the research question, the Chi-Square test was implemented. With that test, we are able to see if there is any relation between two main categories: the digital competence areas and school subjects. In other words, if school subject has any relation on the

development of the digital competence area or if these differences are simply due to random sampling error.

Table 16: Chi-Square Test

Statistics for All Table Factors		
Pearson's Chi-squared test		
Chi^2 = 235.6482	d.f. = 28	p <2e-16
Minimum expected frequency: 0.230908		
Cells with Expected Frequency < 5: 8 of 40 (20%)		

The null hypothesis for the Chi-square test of independence is that there is no relationship between the two categorical variables: digital competence area and school subjects. The alternative hypothesis is that there is a relationship between the two categorical variables. For the example above, the hypotheses are given by the following:

Null: There is no relationship between digital competence area and school subject, so the two categorical variables are independent

Alternative: there is a relationship between digital competence area and school subject, so the two categorical variables are dependent

The key result in the Chi-Square Tests table (see Table 16) is the Pearson Chi-Square. The value of the test statistic is 235.6482, which has 28 degrees of freedom (df = 28).

Since the probability associated (p-value = 0) is lower than the significance level (0.05), we can reject the null hypothesis, which we presume that both variables are independent. Thus, we conclude that there is a relationship between school subjects and digital competence exit profile areas. Correlation between two variables indicates that changes in one variable are associated with changes in the other variable. However, correlation does not mean that the changes in one variable actually cause the changes in the other variable. In this case, we do not know the reason of the relation between digital competences and subjects.

In order to understand better how each school subject comprise digital competence area, a cross-tabulation analysis (Table 17) has been carried out. Each cell contains the following information:

- Count (number of activities identified)
- Chi-square contribution
- Row percent
- Column percent
- Total percent

An example to better understand is resumed in Table 17:

Table 17: Communication competence and Basque subject cross-tabulation example

	Subject
DigComp Area	Basque
Communication	54 (Count or number of activities identified)
	7.199 (Chi-square contribution)
	16.5% (The percent for communication area)
	28.3% (The percent for Basque subject)
	3.2% (The total percent)

Table 18: Digital Competence exit profile areas and subject cross-tabulation

	SUBJECT								
DigComp Areas	Basque	Biology and Geology	English	Maths	Natural Sciences	Physics and Chemistry	Social Sciences	Spanish Language and Literature	Total
Communication	54 7.199 16.5% 28.3% 3.2%	40 0.111 12.2% 20.7% 2.4%	37 0.640 11.3% 22.4% 2.2%	14 21.382 4.3% 6.1% 0.8%	35 1.578 10.7% 24.3% 2.1	23 0.187 7.0% 18.0% 1.4%	94 2.669 28.7% 23.3% 5.7%	30 2.996 9.2% 14.4% 1.8%	327 19.7%
Content Creation	68 0.284 12.3% 35.6% 4.1%	55 1.375 9.9% 28.5% 3.3%	50 0.466 9.0% 30.3% 3.0%	98 6.091 17.7% 42.8% 5.9%	40 1.351 7.2% 27.8% 2.4%	45 0.122 8.1% 35.2% 2.7%	129 0.252 23.2% 31.9% 7.8%	70 0.001 12.6% 33.5% 4.2%	555 33.4%
Information	68 1.689 9.8% 35.6% 4.1%	94 2.291 13.6% 48.7% 5.7%	75 0.567 10.8% 45.5% 4.5%	67 8.469 9.7% 29.3% 4.0%	63 0.149 9.1% 43.8% 3.8%	47 0.754 6.8% 36.7% 2.8%	173 0.128 25.0% 42.8% 10.4%	106 4.104 15.3% 50.7% 6.4%	693 41.7%
Problem Solving	0 9.762 0.0% 0.0% 0.0%	4 3.487 4.7% 2.1% 0.2%	2 4.908 2.4% 1.2% 0.1%	50 125.293 58.8% 21.8% 3.0%	6 0.251 7.1% 4.2% 0.4%	13 6.374 15.3% 10.2% 0.8%	8 7.749 9.4% 2.0% 0.5%	2 7.057 2.4% 1.0% 0.1%	85 5.1%
Safety	1 1.247 33.3% 0.5% 0.1%	0 0.348 0.0% 0.0% 0.0%	1 1.657 33.3% 0.6% 0.1%	0 0.413 0.0% 0.0% 0.0%	0 0.260 0.0% 0.0% 0.0%	0 0.231 0.0% 0.0% 0.0%	0 0.729 0.0% 0.0% 0.0%	1 1.029 33.3% 0.5% 0.1%	3 0.2%
Total	191 11.5%	193 11.6%	165 11.6%	229 13.8%	144 8.7%	128 7.7%	404 24.3%	209 12.6%	1663

According to the communication area (Figure 21 and Table 18), one third of the activities identified are related to language subjects: Basque (16.5%), English (11.3%) and Spanish Language and Literature (9.2%). Another relevant school subject is Social Sciences, as the 28.7% of the activities of communication area are related to that subject. It is also remarkable the data from Biology and Geology (12.2%), Natural Sciences (10.7%) and Physics and Chemistry (7%) school subjects, taking into account that there are taught during the last two years.

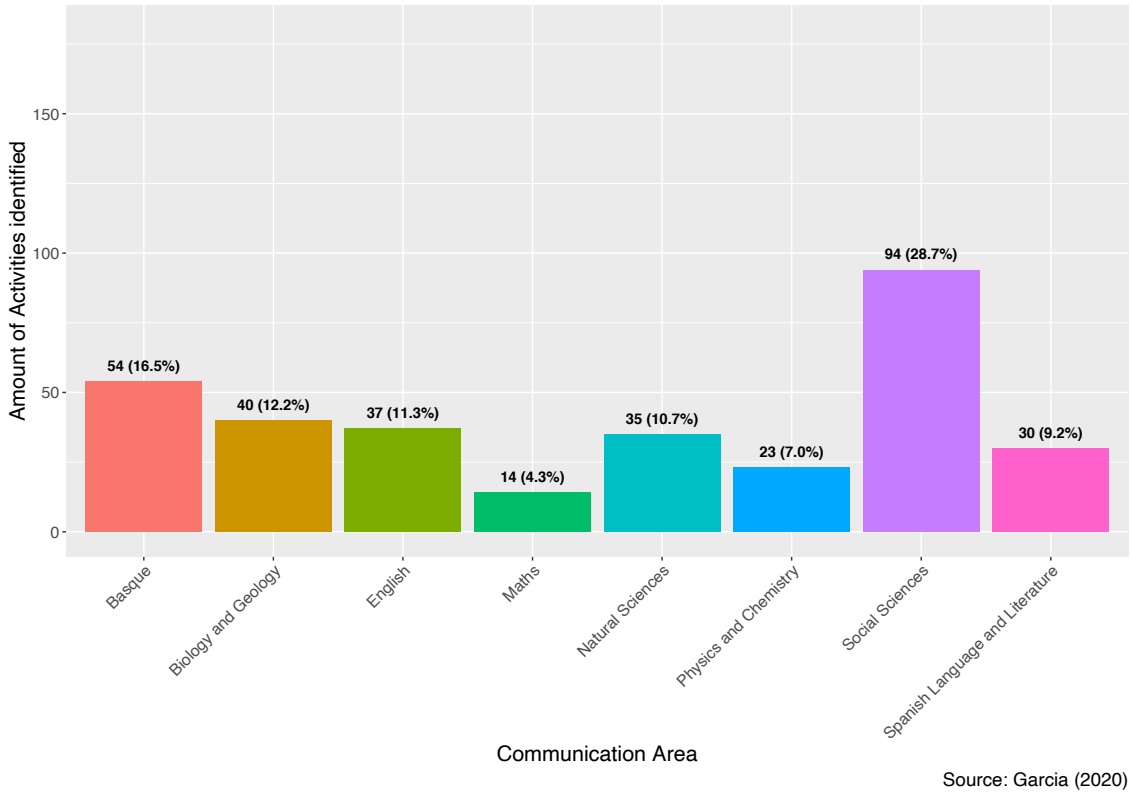


Figure 21: Communication area activities by subjects

If we now turn to content creation area (Figure 22 and Table 18), most of the activities are concentrated in Social Science school subject (23.2%), followed by Maths (17.7%) and Spanish Language and Literature (12.6%). Similarly, Basque (12.3%), Biology and Geology (9.9%), English (9%) have significant development, as well as Physics and Chemistry (8.1%) and Natural Sciences (7.2%). It should be taken into account that the last two mentioned school subjects only are developed through the last years.

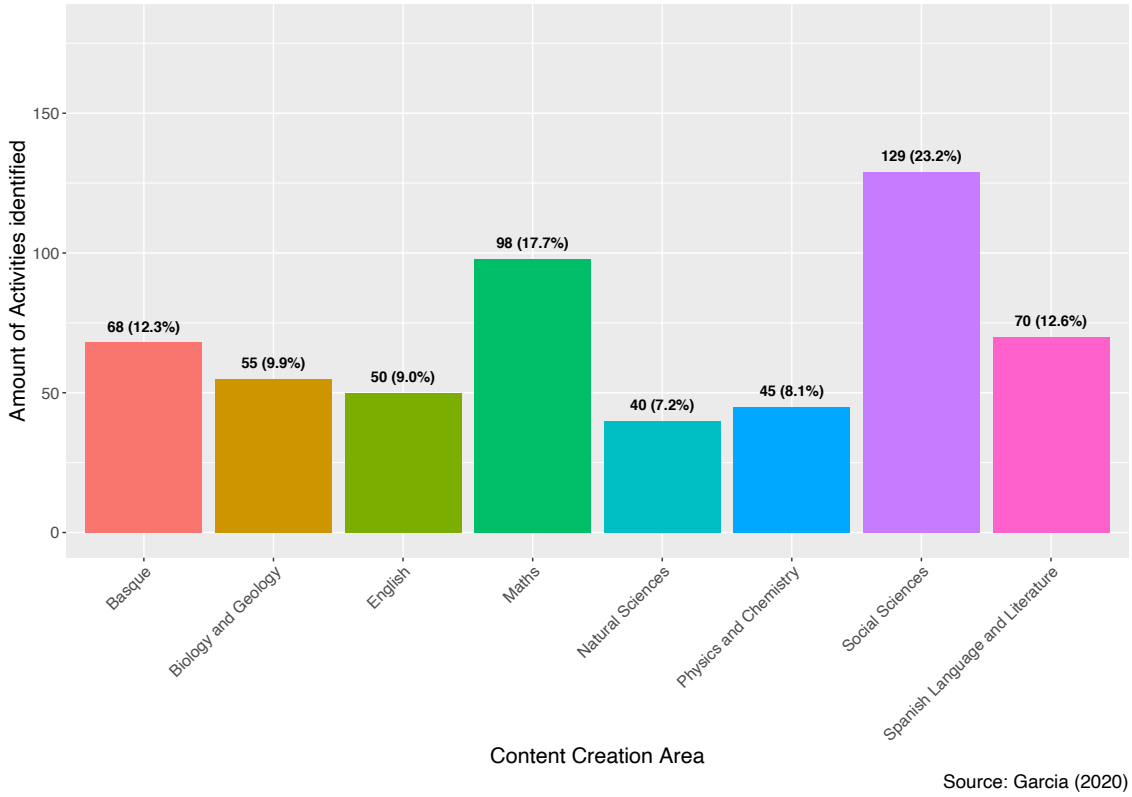


Figure 22: Content Creation area activities by subjects

Turning now to information area (Figure 23 and Table 18), similar to content creation area, Social Science (25%), Spanish Language and Literature (15.3%) and Biology and Geology (13.6%) school subjects are the most developed ones. While English (10.8%), Basque (9.8%), Maths (9.7%) and Natural Science (9.1%) school subject activities identified are more than 60, Physics and Chemistry (6.8%) just have 47 identified activities.

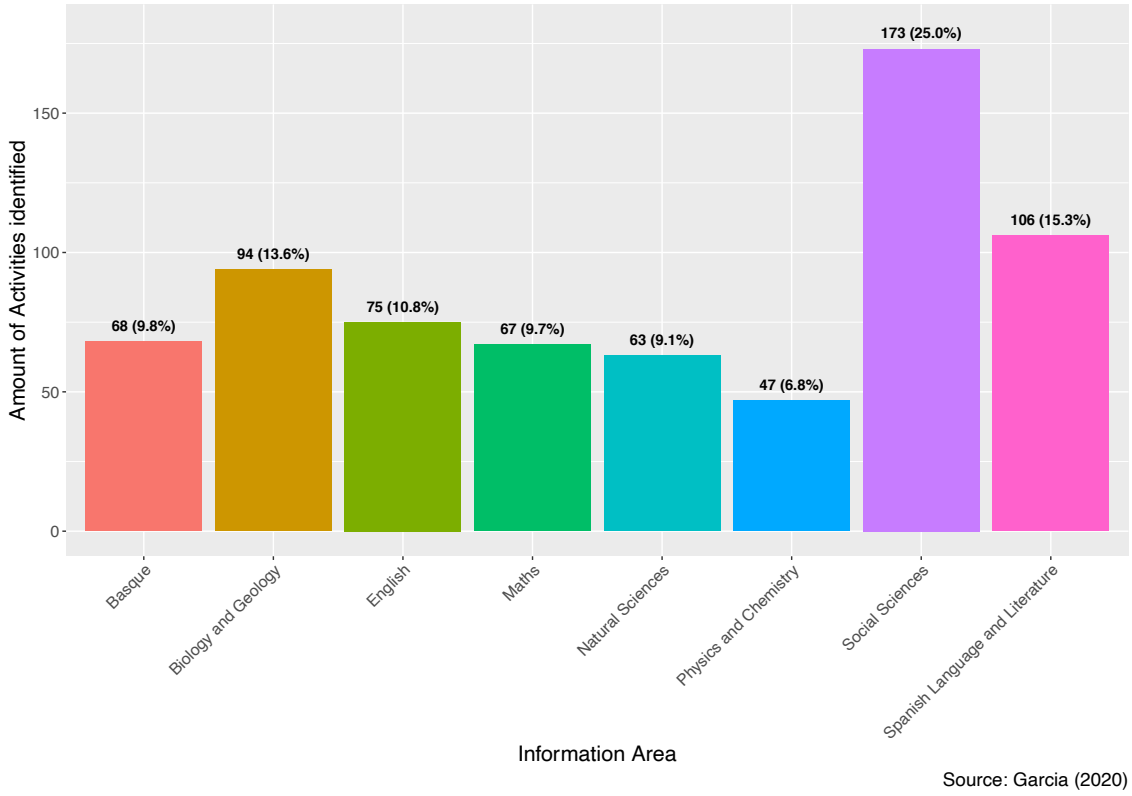


Figure 23: Information area activities by subjects

Although the areas described before are the most developed ones, problem solving area is also developed (Figure 24). The most significant outcome is related to Maths (58.8%) school subject, with just only 50 activities. Not only Maths, but also Physics and Chemistry (15.3% and 13 activities), Social Sciences (9.4% and 8 activities), Natural Sciences (7.1% and 6 activities), Biology and Geology (4.7% and 4 activities), English and Spanish Language and Literature (2.4% and 2 activities each) school subjects activities were identified within problem solving area.

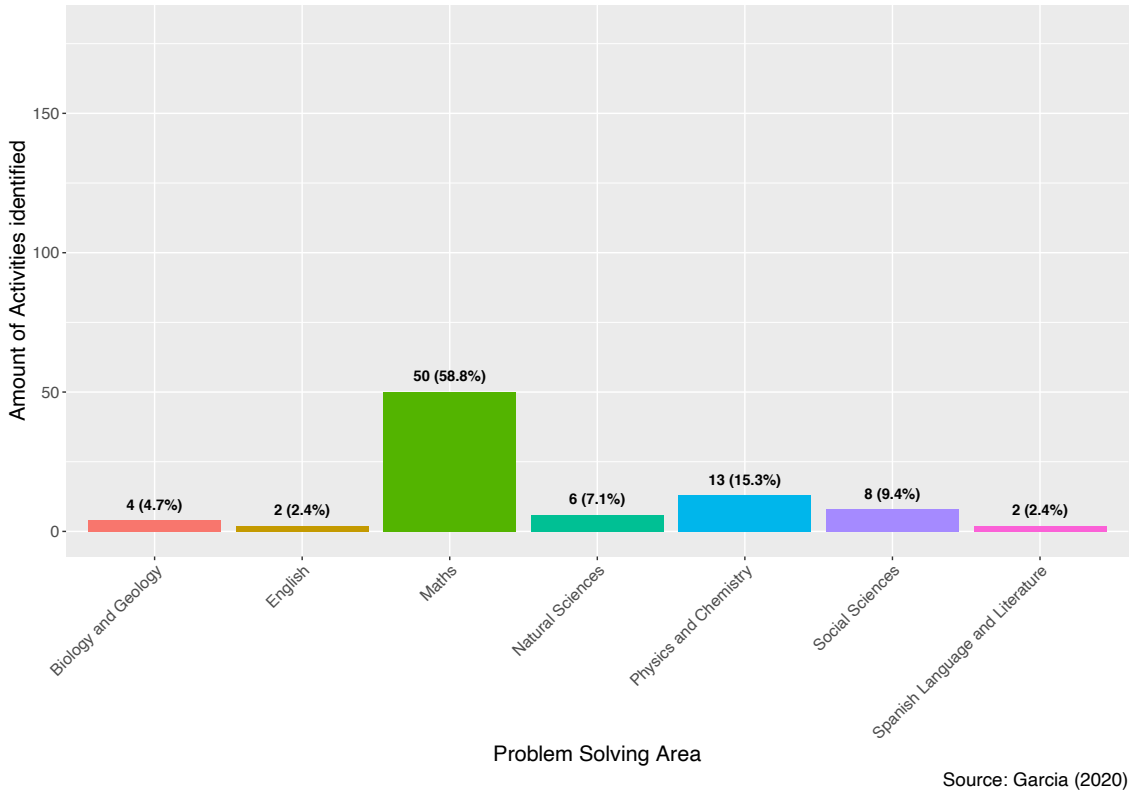
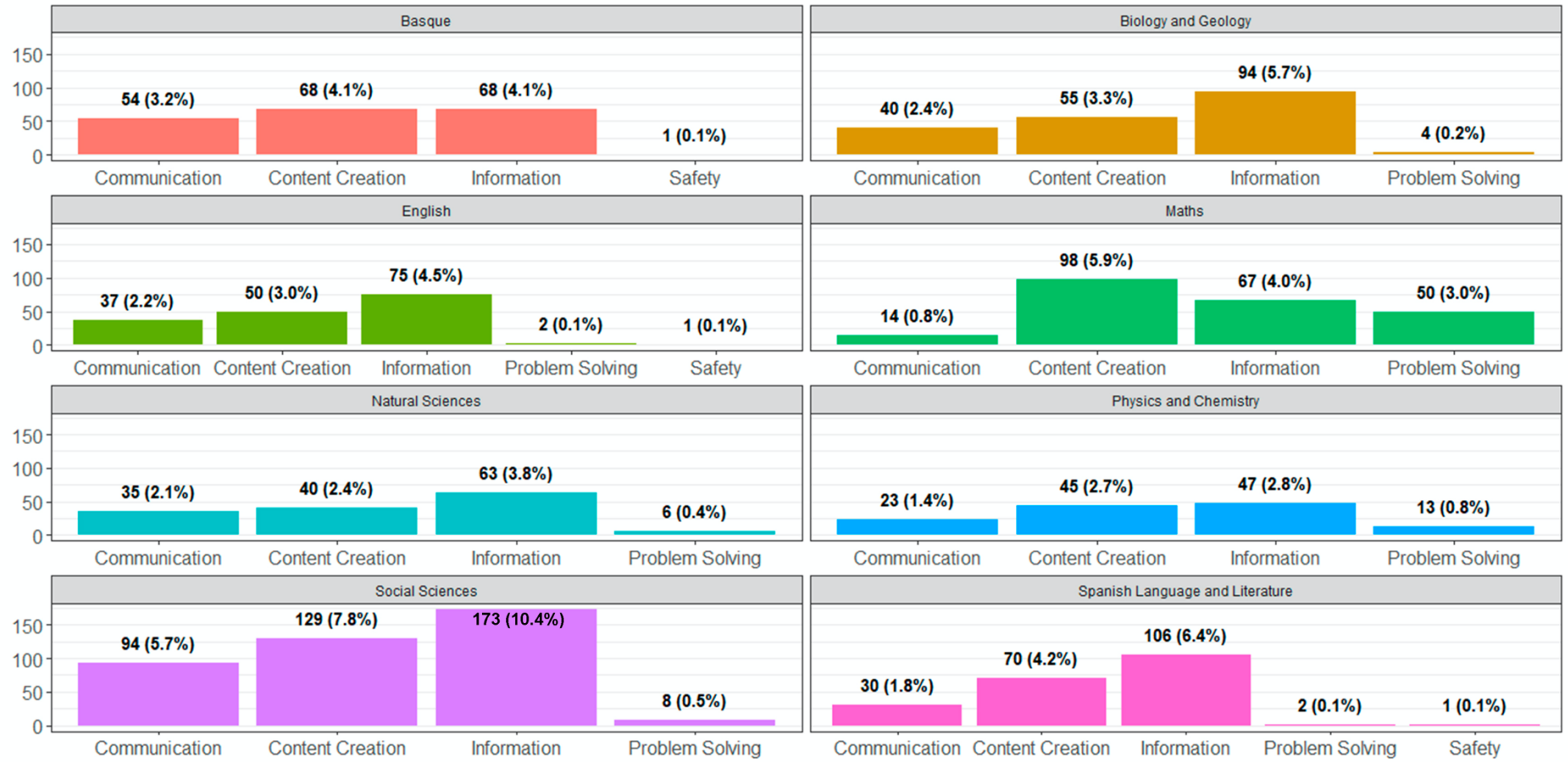


Figure 24: Problem solving area activities by subjects

The most striking observation to emerge from the cross-tabulation (Table 18) is concerning to the safety area. Even if the subjects related to language (Basque, English and Spanish Language and Literature) represent the 33.3% of the activities each, only 3 units were considered to have relation with security area (see Figure 25). That means that security area (0.2%) is not even minimally develop in depth with the EKI teaching material.



Source: Garcia (2020)

Figure 25: Amount of activities identified for each subject grouped by digital competence area

Moving now to analyse the data through school subjects shown in Table 18, Social Science subjects binds the 24.3% of the total activities identified, while Physics and Chemistry subject just come on 7.7% of the activities. The amount of activities identified in Maths (13.8%), Spanish Language and Literature (12.6%), Biology and Geology (11.6%) and Basque (11.5%) contrasts with English (9.9%) and Natural Sciences (8.7%). These results suggest that most of the school subjects are developed in a similar way.

However, the figure above (Figure 25) shows the activities identified for each school subject grouped by digital competence area. With regard to Basque school subject, the same percentage of activities were identified for content creation and information area (35.6%), followed by communication area (28.3%). Also, just an activity for safety area was identified being the 0.5% of the activities identified for Basque school subject.

In addition, slightly less than half of all identified activities of Biology and Geology school subject are from information area (48.7%), while content creation (28.5%) and communication (20.7%) areas are quite developed. Not only, but also problem-solving area has been identified with 2.1% of the activities of the subject.

Furthermore, the 45.5% of all identified activities of English subject are related to information area, whereas the 30.3% is related to content creation. In less percentage, communication (22.4%), problem solving (1.2%) and safety (0.6%) are also developed through that subject.

By the same token, quite less than half of all identified activities related to Maths, are from content creation area (42.8%), while those related to information and problem solving are, 29.3% and 21.8% respectively. The last but not least develop area is communication with the 6.1% of the activities of Math subjects.

Besides, the 43.8% of the activities of Natural Science are related to information, whereas the 27.8% and 24.3% of the activities are from content creation and communication area. Problem solving area is developed in Natural Science within the 4.2% of the activities.

Likewise, content creation (35.2%) and information (36.7%) areas are developed in a quite similar way in terms of Physics and Chemistry school subject. In contrast, communication (18%) and problem solving (10.2%) are developed but in a less manner.

Similar to Biology and Geology subject, Social Science most activities are concentrated into information area (42.8%), while the second and third most developed areas are content creation (31.9%) and communication (23.3%), followed by problem solving (2%).

Finally, half of the Spanish Language and Literature school subject activities concern to information area, while the 33.5% are related to content creation and the 14.4% to

communication. In just a unsignificant way, 1% of the activities are from problem solving area, and just 0.5% to safety area.

4.5 SUMMARY

The findings presented here demonstrate the complex process to fulfil all the digital competence exit profile trough the EKI educational resource. Although all digital competence areas were identified through the activities, not all the areas are developed in the same way.

What emerged in my research and in answer to research questions two and three: *are all the digital competences developed with EKI educational resource?* and *Which are the proficiency levels for each digital competence defined in the exit profile according to EKI learning activities?* was that not all the digital competences are developed and those that are developed, some do not reach to the proficiency level stated in the exit profile.

The last research question (*What is the relation between the school subject and the development of digital competence?*) has been the most difficult to answer. While analysing the activities by school subject and digital competence area, it was difficult to know why some school subjects facilitate the development of digital competences. It is true that some link and relation exist between the development of digital competence and school subjects, but many factors could affect: the digital competence of educational resource creators, each teachers' digital competence, etc.

Chapter 5: Discussion

As presented in the previous chapter, the overall research topic is examined through a content analysis quantitative analysis. The results have been presented in the previous chapter, and in this chapter, I discuss the overall contribution of my thesis, before I end the chapter with some concluding remarks and recommendations for further research.

5.1 GENERAL DISCUSSION

The purpose of the research project was to explore the development of the digital competence exit profile of Basque secondary school students through the EKI educational resource. The educational resource has been explicitly looked and analysed to know at what extent helps to develop the digital competence exit profile defined. The overarching question which the research sought to answer is: *"Does the EKI educational resource embrace the digital competence exit profile?"*.

The following sub-questions were set out to answer:

> RQ1.- How are the digital competence exit profile areas developed with EKI educational resource?
>
> RQ2.- Are all the digital competences developed with EKI educational resource?
>
> RQ3.- Which are the proficiency levels for each digital competence defined in the exit profile according to EKI learning activities?
>
> RQ4.- What is the relation between the school subject and the development of digital competence?

In the sub-section that follow, research questions are addressed, and the implications of findings are discussed.

5.1.1 THE DEVELOPMENT OF DIGITAL COMPETENCE EXIT PROFILE AREAS THROUGH EKI EDUCATIONAL RESOURCE (RQ1)

Digital competence has become a transversal competence that every member of society requires in order to ensure active involvement in the 21st century. The development of digital competence in the education system ensures that both students and teachers are educated in it, which includes making them capable of using ICT effectively as a methodological resource incorporated into the teaching and learning process (Miguel-Revilla, Martínez-Ferreira, & Sánchez-Agustí, 2020).

The information area has been the most identified area in the EKI educational resource with almost the half of the activities identified. A recent study by Rolf, Knutsson and Ramberg (2019) examined the characteristic of learning activities designed by upper secondary teachers for technology use in terms of digital competence. In that study one third of the of the activities

make reference to information and data literacy area and almost half of the activities were related to communication and collaboration area (Rolf et al., 2019). The web allows students find information making a difference between authentic and teacher created materials (Dudeney & Hockly, 2007).

Content creation and communication were the other two areas more developed in the EKI educational resource. There is a large number of published studies (e.g., Carrió-Pastor, 2007; Carrió-Pastor & Skorczynska, 2015; García-Valcárcel-Muñoz-Repiso, Basilotta-Gómez-Pablos, & López-García, 2014) that determined that collaboration between students improves learning. In the EKI educational resource, developing content and collaborating through digital channels are two of the four most developed competences.

Problem solving area was the fourth most developed area, being one of its competence only noteworthy developed. Such competence follows to experiment with technology, to actively engage in collaborative digital and multimedia development, to express oneself creatively through digital media and technologies, to build information and to solve conceptual problems by supporting digital tools (Ferrari, 2013).

Similar to Rolf et al. (2019), safety area is not involved in any learning activity or as it happens in this research it is insignificant. According to EU KIDS research, young people are considered to be fluent new media users but, at the same time, they need intensive support based on improving their digital competence in the field of safety (Pyżalski, Zdrodowska, Tomczyk, & Abramczuk, 2019). Safety from threats is the responsibility of significant others; that is, parents and teachers (Tomczyk, 2020). In view of the dynamic nature of ICT-mediated problematic circumstances, adults need to recognize and be able to promote adequate socialization of the Internet, skills which reach far beyond the usual use of digital media for information and entertainment reasons (Neumann, 2016). It will be appropriate that children undertake many more online activities but without an increase in their online risk. It is interesting to learn from initiatives in countries where risks are lower or opportunities are higher, such as, Lithuania and Estonia (Smahel et al., 2020).

5.1.2 THE DEVELOPMENT OF COMPETENCES WITH EKI EDUCATIONAL RESOURCE (RQ2)

These findings will doubtless be much scrutinised, but there are some immediately dependable conclusions for development of digital competences defined in the exit profile through EKI educational resource. Just eight out of twenty-one competences were noteworthy identified to be developed.

Students are perceived to be more competent in the skills related to their daily habits of use, such as analyse and search content on the Internet (Bravo, Jiménez, & de Cózar, 2017). The

results of this study share in common as the competences related to information area are those most developed.

Integrated learning lectures enable innovative learning designs that are responsive to technological innovations. In addition to enhancing the comprehension of instructional materials, student digital literacy should also be enhanced with integrated learning so that students can process digital knowledge independently, efficiently and responsibly (Hasanah & Dewi, 2019).

Prensky (2005) said that today's students are demanding for technology to be incorporated in ways that suit their expectations and desires. So (2009) added that convenience and quick access to contact at any time and compatibility with current procedures are essential qualities that are useful for group communication. Students consider social media networks to be a "social glue" rather than a structured teaching tool (Berns, Gonzalez-Pardo, & Camacho, 2013). The majority of teachers may not be aware of the nature and extent of students' expertise that relates to their out-of-school uses of ICT (Sutherland, 2004).

Also, those competences referring to content creation are meaningfully developed. Many studies revealed that content creation is closely related to socioeconomic background (Brake, 2014; Drotner, 2020; Hargittai & Walejko, 2008). However, despite the socioeconomic background, there are only minor variations in children's access to digital devices related to the socio-economic status of parents (Paus-Hasebrink, Kulterer, & Sinner, 2019). They know how to acquire the knowledge required to learn and then apply new skills, e.g. through video tutorials or online forums (Telia, 2017), to create new (digital) content. Using digital technologies in this way will enhance children's creativity (Lorenz & Kapella, 2020).

One unanticipated finding was that any of the safety competences were developed, although nowadays everyone leaves a digital footprint in an online environment and activity. Livingstone et al. (Stoilova, Livingstone, & Nandagiri, 2019) suggest that children today worry a lot about what personal information they share with their peers or parents. EU Kids online data from 2019 reveals that 8 to 17 percent of 9-16-year-old children have come across various forms of potentially harmful online content (Smahel et al., 2020). So, apparently safety area should be developed in the EKI educational resource.

5.1.3 THE PROFICIENCY LEVELS FOR EACH DIGITAL COMPETENCE DEFINED IN THE EXIT PROFILE ACCORDING TO EKI LEARNING ACTIVITIES (RQ3)

These findings have significant implications for the understanding of how the digital competence exit profile is developed through EKI educational resource. According to the proficiency level for each digital competence, it can be concluded that the exit profile should be redefined, in order to assure that the exit profile is developed (see Table 19).

Overall, the present study strengthens the idea that a new and contextualized definition of digital competence and its exit profile is needed. It is necessary to take into account the definition of the digital competence done in the second chapter, as from that definition, only making minimum changes to it, the new digital competence exit profile raised and definition became congruent. So, the new definition could be as: *digital competence is a mixture of knowledge, skills and attitudes towards the use of technology to perform activities, solve problems, interact, organize and manage information, cooperate and collaborate, and develop and exchange content efficiently, correctly, critically, creatively and independently*.

From the new definition, it is possible to match it with the new digital competence exit profile. Interact, organize and manage information makes reference to information area, cooperate and collaborate as well as exchange content could be part of communication area, develop content efficiently, correctly, critically, creatively and independently is a clear reference to content creation, while solve problems it is intrinsically linked to problem solving area.

This approach will prove useful in expanding our understanding of how Basque secondary school students' digital competence is developed through EKI educational resource. Although some competence reach to the expected exit profile, some of them had to be redefined.

All the proficiency levels of digital competences related to information and content creation area proposed in the new exit profile (Table 19), should be redefined in order to be coherent between the educational resource and the digital competence exit profile. A close issue to that happens *to 2.2 Collaborating through digital channels* competence. It is initial proficiency level was established as advanced level, and now is redefined as intermediate.

Just two competences, *2.1 Sharing information and content* and 4.1 Innovating and creatively using technology, proficiency levels do not need to be revised, for the reason that the initial proficiency level requirements are set out.

Another solution could be to redefine the activities in order to reach the exit profile propose by the Basque Government (2015b). This requires a great deal of effort on the part of the creators of educational resources, as they must understand and grasp digital competence as a key competence. As Helsper (2008) identifies, achieving a singular concept of digital competence is difficult, due to continuously changing technological, cultural and social environments

redefining what, when and how digital technologies are used in academic and interpersonal activities. SAMR model (Aldosemani, 2019; Baz, Balçıkanlı, & Cephe, 2018; Beisel, 2017; Kihoza, Zlotnikova, Bada, & Kalegele, 2016; Sardone, 2019) (substitution, augmentation, modification, redefinition) is basically a descriptive structure that hierarchically maps the various educational uses of technology against levels or stages—progressing from substitution ('doing digitally' what has historically been done using conventional resources) to redefinition (curriculum, pedagogy and practice reconceptualised through digital technologies). SAMR has been widely adopted by teachers and schools as a pragmatic guide to signalling progress in ICT growth, working towards what is seen as the utopian position of curriculum redefinition via technology (Geer, White, Zeegers, Au, & Barnes, 2017; Hilton, 2016). According to Puentedura (2013), at the stage of redefinition, "technology enables the creation of new, previously inconceivable tasks". This model can be valuable in redefining the exercises proposed so far by the EKI educational resource.

Table 19: Digital Competence exit profile proposal[3]

Information	Communication	Content-Creation	Problem-solving
1.1 Browsing, searching and filtering information	2.1 Sharing information and content	3.1 Developing content	4.1 Innovating and creatively using technology
Intermediate	Intermediate	*Intermediate*	Intermediate
1.2 Evaluating information	2.2 Collaborating through digital channels	3.2 Integrating and re-elaborating	
Intermediate	*Intermediate*	*Intermediate*	
1.3 Storing and retrieving information			
Advanced			

[3] Those proficiency levels in italics have been redefined

5.1.4 RELATION BETWEEN THE SCHOOL SUBJECT AND THE DEVELOPMENT OF DIGITAL COMPETENCE (RQ4)

One of the more significant findings to emerge from this study is that there is a correlation between the subjects and digital competence development. Although teachers are concerned with preparing students for future studies and work (Vuorikari et al., 2016), practices of teachers are not enough to guarantee that students develop the competences they need to work in the future (Ungerer, 2016). Both learners and teachers need to develop digital competences and, of course, to obtain this, they need resources adapted to those goals (Hanbidge, Sanderson, & Tin, 2015).

The EKI educational resource has been created by teachers specialized in their subjects, not in digital competence. Teachers are experts in pedagogy in contrast to most designers of digital resources (Kervin, Danby, & Mantei, 2019). There is a strong connection between the lack of development of digital competence and the lack of preparation (Sánchez-Caballé, Gisbert-Cervera, & Esteve-Mon, 2020). Lifelong learning and training is needed because those teachers who acquire those digital competences will then be able to teach them to their students (Korucu, Yucel, Gundogdu, & Gencturk, 2016; as cited in Sánchez-Caballé et al., 2020). It is important to provide examples to teachers of bridges between learning goals related to digital literacy of different sorts (Bekker, Bakker, Douma, Van Der Poel, & Scheltenaar, 2015).

It is recognized that skill development is spread through the task, across the individual as well as across the personal and social context (Barab, Fajen, Kulikowich, & Young, 1996). The situational barrier of inexperience, access to mobile devices and the internet has been described as the key obstacles that led the student to become digitally competent (Korucu et al., 2016; Muller, 2017). It is the duty of the institution to encourage the use of technology by its members (Puchmüller & Puebla, 2014; as cited in Sánchez-Caballé et al., 2020).

With regard to the content of teaching, research studies have examined the conversion of content from national curriculum to teaching scheduling, and the preference of teachers as to what basic content should be taught in a particular lesson and why. Loveless (2007, 2011) argues that a professional knowledge teaching framework that emphasises the relationship between subject-matter knowledge, the didactic relationship with digital technology, and a range of teaching scenarios will help teaching with digital technologies.

The digitization of schools has changed the nature of teaching and learning, and according to Edwards (2015), improvements in the use of ICT have had a profound effect on the work of teachers. Teachers' pedagogical reasoning, as a method of finding and taking advantage of the added value of ICT in teaching, appears to be a way of reshaping the teaching process and

teaching experience (Holmberg, Fransson, & Fors, 2018). Other research also indicates that learning environments, including ICT tools, provide new possibilities, requiring pedagogical reasoning from teachers that is more nuanced than before (Loveless, 2011; Voogt & Roblin, 2012).

In education, teachers and students use software applications that provide various modes of communication. Didactic issues about software systems have been discussed in the area of science. Wegerif (2004) argues that with the right educational software, computers can work interactively towards curriculum objectives, but at the same time function as a learning space in which students can explore their ideas. Examples provide access to metacognitive abilities of pupils using techniques such as facilitation and problem-solving (Barnes & Kennewell, 2017).

However, many of the software applications used in classrooms are not intended for educational purposes. The same type of digital software used by different teachers and pupils can also create different experiences between teachers and pupils as well as between pupils and the digital resource (Pettersson, 2018).

Previous classroom research points out that digital technologies challenge conventional teaching because they include a variety of modes of speech and communication and are not confined to the traditional paper medium (Jewitt, 2009; Kress, 2010). Both students and teachers orchestrate digital tools during interaction. The increasing number of multimedia resources and digital teaching practises make it imperative for teachers and pupils to build communication skills through media and other visual means of communication (Jewitt, 2009; Kress, 2010). In the digital age, teachers must use modern pedagogical approaches and consider how ICT and pedagogy communicate to promote the development of competence among their students (Lim, Zhao, Tondeur, Chai, & Tsai, 2013; Voogt, Erstad, Dede, & Mishra, 2013).

Most of the research focuses on the basic competencies required by teachers and thus appears to ignore the impact of broader contextual factors in a wider school setting (Pettersson, 2018). However, efforts have also been made over recent years to address pedagogical dimensions of digital competence from a conceptual perspective (From, 2017). From (2017) focuses on pedagogical dimensions as a particular function of the wider concept of digital competence. Similarly, Krumsvik et al. (2016) suggests the incorporation of pedagogical dimensions in the concept of digital competence.

Following the same line of thinking, Vanderlinde and van Braak (2010) emphasize the value of supporting organisational infrastructure, the creation of policy documents and strategic leadership that can assist teachers in translating policies into practical objectives, where teachers can bring these objectives into action in daily teaching practise. Wastiau et al. (2013) also recommend a holistic policy organisation, leadership and supporting organisational

infrastructure in order to achieve the technology integration and the growth of the digital skills needed. The design of a learning and educational management ecosystem is the result of a sum of strategic decisions that affect the various processes involved in an educational organisation and the various agents that are part of it (Martí, Gisbert and Larraz, 2018).

The examples above illustrate the complexity of digital competence when implemented in educational contexts. The didactic question, however, is what it would take to develop digital competence and what that competence would look like in today's digital schools (Kjellsdotter, 2020).

Some research on the usage of digital technology by adolescents mostly focuses on how young people use out-of-school rather than in-school technology (Ehrlich, Sporte, & Sebring, 2013; Fitton, Ahmedani, Harold, & Shifflet, 2013). Other research studies explore the usage of in-school technology from a student viewpoint and show less overall use of digital technology in school than outside school (Bulfin, Johnson, Nemorin, & Selwyn, 2016; Hughes, Read, Jones, & Mahometa, 2015; Steinberg & McCray, 2012).

Technology usage in schools can be classified in a number of ways, including productivity, training and creation (Roblyer & Hughes, 2019). Steinberg and McCray (2012) interviewed middle school students who were eager for even more teacher-modeling student-centered, active technology learning. Wang, Hsu, Campbell, Coster, and Longhurst's (2014) analysis of middle school science classrooms found students most often used word processing, spreadsheets, presentation tools, and web searches. That is clearly relationed with EKI educational resource, where the main tools make reference to web searching and content creation. Across these studies of in-school technology integration, only Wang et al. (2014) specifically examined technology integration in a subject matter.

Subject area discrepancies can also be clarified by subject area cultures (Hew & Brush, 2007; Selwyn, 1999), which guide teaching practises and teaching approaches in the classroom that may or may not be compatible with pedagogy and teaching approaches offered by technology and the Internet.

In a study conducted by Olofsson, Fransson and Lindberg (2020), all teachers stressed the need for students and teachers to have access to digital technologies as a matter of democracy. Krueger and James (2017) frame digital equity as “the civil rights issue of our time”. The Hughes and Read (2018) studies exemplify inequity in digital infrastructure (e.g. access), pedagogy (e.g. more teacher-driven technology use) and content-based learning (e.g. less technology use in science and mathematics, similar to what happens in EKI educational resource).

Alvermann, Hutchins, and McDevitt (2012) suggest that teachers and schools should develop informal or formal ways of interpreting students' digital experiences. Bulfin et al. (2016) conclude that in terms of school-related activities, the predominant activity mentioned by almost all students was finding information – mainly using Internet search engines such as Google. Other common activities were consuming content and making/writing/creating. Similarly, to the results of this study, the main area identified has been the information area, followed by content creation. These results contrast with the most popular applications of emerging technology for non-school activities as watching content (e.g. videos, music), communicating (mobile phones, messaging), checking/updating social media and playing games (Bulfin et al., 2016). By listening to students, learning experience can be (re)designed to help learners succeed in all school subjects (Alvermann et al., 2012).

It is clear that technology integration and digital competence development through educational resources, are shaped by the diverse ecosystem of individuals (school community), organisations, policies and available technology (Bull, Spector, & Persichitte, 2017; Ertmer & Ottenbreit-Leftwich, 2010; Hughes, Ko, & Boklage, 2017; Y. Zhao & Frank, 2003; Y. Zhao, Pugh, Sheldon, & Byers, 2002).

Chapter 6: Conclusion

6.1 GENERAL CONCLUSIONS

The aim of this research was to analyse the extent to what the Basque secondary school students' digital competence exit profile was fully developed using the EKI educational resource.

Regarding the results, it can be defended that the exit profile is not fully developed. Pointing out the digital competences areas (RQ1), it is true that some areas are more developed as information, communication and content creation, while security and problem solving are not. But, if we look in depth to the data obtained, we could be able to differentiate areas from competences (RQ2). Not only few competences are developed, but also those ones are highly developed. Competences related to information area are all developed, as well as those competences related to communication (2.2 and 2.4) and content creation (3.1 and 3.2) are developed with EKI educational resource.

Moreover, the third research question address the proficiency levels of each digital competence (RQ3). According to information area competences (1.1 and 1.2), these proficiency level should be advanced, and the study concludes that proficiency level should be redefined to intermediate level in case the selected educational resource is the only material selected to that school period. Otherwise, the exit profile would not be realistic. The area of information and data literacy is an appropriate priority for upper secondary teachers as they are concerned with preparing their students for future academic studies, and other competences that may be considered crucial for EU citizens (Vuorikari et al., 2016) are simply less relevant, although not completely ignored by the upper secondary teachers (Rolf et al., 2019). The creation of supportive requirements for all students to be able to meet the demands of today's information society, as well as the opportunity to take a critical stance, is noted by Lindqvist and Pettersson (2019).

In addition, communication area competences are developed in many ways. Only two of the competences are developed, even one of it (2.4 competence) does not reach to the minimum proficiency level, while the remaining competences are not significantly developed in the EKI educational resource. Similar to Ahonen and Kinnumen (2015), students ranked social skills and collaboration as the most important competences they would need in the future, so it is necessary to develop the competences related to that area.

As regards content creation area, the competences that are developed, such as, 3.1 and 3.2, are not enough developed to reach the proficiency level described on Figure 17. According to that, the findings of the study report that even if the area looks developed, it is not due to all the competences related to it. Therefore, either the exit profile is redefined according to the EKI

educational resource or more activities should be suggested in relation to content creation area competences.

Moreover, one of the more significant findings to emerge from this study is that neither security nor problem solving areas are developed. While one of the problem-solving competences (5.3) is scarcely developed, none of the security competences is worked out on EKI educational resource. According to that, Livingstone, Mascheroni, Ólafsson and Haddon (2014) remark that educators should promote positive, safe, and effective use of technology by children in all educational contexts and integrate online safety awareness as well as digital skills across the curriculum. The school is the second most important place for Spanish children to access the Internet (Garmendia Larrañaga, Jiménez Iglesias, Casado del Río, & Mascheroni, 2016). It can then be a space where they are taught how to make safe and appropriate use of the internet.

Evidence from this study concludes that the exit profile should be redefined as Ferrari (2013, p. 9) remarked each institution should adapt to their needs. As mentioned before, it should be easier to redefine the exit profile according to the results of the study. Moreover, this research confirmed that there is a correlation between school subjects and digital competence development.

Therefore, the research has a number of implications for educational resource creators and designers. As key competence (European Commission, 2010), it should be taken into account when an educational resource is designed and created. It is true that digital competence is not only developed in academia, but also out of it (Ilomäki, Kantosalo, & Lakkala, 2011; Ilomäki, Paavola, Lakkala, & Kantosalo, 2016b). However, as EKI does, an educational resource should raise activities in which the student should be able to handle a variety of real-life problems including those referred to digital competence. We need more information about how to develop good strategies among students (Weinstein, Husman, & Dierking, 2000). With the possibilities offered by digital technologies, it is possible to increase the focus on student-centred activities and increase, amongst others, the level of self-assessment, peer feedback and e-portfolios (Brečko, Kampylis, & Punie, 2014).

The research also has pedagogical implications for teachers. The educational resource is used mainly by teachers and students. According to a survey conducted by the European Commission (European Commission, 2019), teachers seem to be most confident in the DigComp areas safety, communications and collaboration, as well as information and data literacy, while they seem to be least confident in the area of digital content creation. That is why it is necessary to highlight that teachers also need to achieve digital competences in favour of their dairy professional development, adopting the DigCompEdu framework (Redecker & Punie, 2017). That framework takes into account educators' professional competences, educators' pedagogic

competences and learners' competences. This latter takes into account the DigComp framework areas. DigCompEdu encouraged to adapted and modified the framework to the specific context and purpose. Perhaps, EKI teaching material should take into account DigCompEdu framework in order to facilitate and enhance teaching and learning processes.

6.2 LIMITATIONS

As with all research, this study has its limitations, and it is important to acknowledge these limitations. Firstly, the research was conducted in a very specific context. I investigated the phenomenon of developing digital competence trough a specific educational resource. The second limitation was the lack of expertise in digital competence research in the Basque Country context or those whose area of research is digital competence knows Basque.

The first limitation of my study is the specific context of my research. Not only location and time but also the educational resource was unique. My research took place in the Basque Country and in a Basque language context. The EKI educational resource is only in Basque and this means that not only students and teachers, but also the creators of educational material and researchers must understand Basque. Also, my research took place during the implementation of the educational resource and it is true that the years followed to this research, some new educational resource was created to primary school students. So, it is possible that students who pass to upper secondary school are now more digitally competent than the ones do not have it.

As a consequence of the particular context of my study, results are only applicable or relatable internally within the Basque Country context or those who use the EKI educational resource. As Dzakiria (2006) points out, the ability to expand internal and external generalization is not beyond the scope of any researcher. However, the reader can make generalizations based on the premise of relatability (Dzakiria, 2006).

In the case of data analysis, one limitation has been the difficulty to find a researcher expert in digital competences and educational resources, as well as knowing Basque. In the initial design of the study, before analysing the EKI educational resource, the researcher assumed that the analysis of the material would not be enough within the review of one research. At least, the researcher found one research who collaborate during the research and help to make the research more reliable. In order to assess the degree of consistency in decision-making between coders, there must be some overlap in coding, i.e. at least two coders must make decisions on the same content (Potter & Levine-Donnerstein, 1999, p. 273). The standard indicator of intercoder reliability in the content analysis technique is to have a pair of encoders evaluate the same subset of the sample, as happened in this research.

6.3 FUTURE PROPOSALS

Digital competence is an indispensable skill for the inhabitants of today's community and must therefore be continuously developed and regularly measured, taking into account the components of knowledge, skills and attitudes (Hazar, 2018). However, the assessment and recognition of student digital skills is still a major challenge, as has been pointed out by Colás Bravo, Conde Jiménez and Reyes de Cózar (2017).

As information skills are inextricably related to wider digital skills, developing information skills includes comprehensive curriculum and formal education to concentrate on students' overall digital skills (Kaarakainen, Saikkonen, & Savela, 2018). On the basis of van Deursen and van Dijk (2013), attempts to minimize the inequalities of digital skills in general, awareness of human use habits plays a major role in the development of more of these skills.

It can also be remembered that digital technologies will be used in an increasingly digitizing environment and digital content will be consumed in society. ICT skills can be gained by using social media, playing computer games, finding knowledge, and performing everyday activities on the Internet (Kaarakainen, Kivinen, & Vainio, 2018). Thus, in addition to informal learning, formal schooling can help ensure the opportunity to succeed in a digital world and enable all people to benefit from digital participation in the future.

It is not enough to have a specialized teacher on digital skills and ICT, whose main responsibility is the teaching of ICT skills or helping students to develop digital competences. Instead, it will become the responsibility of every teacher. That is why the improvement of all ICT skills and digital competences of teachers and the narrowing of current skills gaps amongst all teachers is important in the pursuit of equitable digital learning opportunities for all students at all levels of education (Kaarakainen, Kivinen, et al., 2018).

With the degree of advancement of information and communication systems, selection and evaluation skills play an increasingly important role in the professional profile of the teacher and influences the performance of the teacher in the classroom and beyond in the overall education process. Technology and content skills are at the forefront, and it is becoming increasingly important to demonstrate and extend the possibilities for increasingly diverse learning methods through numerous digital learning tools. All this, in the sense of improving the skill of pedagogical experts with respect to the diverse knowledge of digital instructional tools, will ensure their more objective and comprehensive use in the teaching sector as well as their continued development in the variety of relevant learning strategies (Tsankov & Damyanov, 2019).

We need a paradigm that takes into account that technology is a medium for educational purposes, but also a kind of information and interaction with the environment, human behaviour

and a source of values (De Vries, 2016). For such purpose, Castañeda, Esteve and Adell (2018) create a model of Integral Teaching Competence for a Digital World, where two of the main aspects to be taken into account are that future teacher should be generator and manager of emerging pedagogical practices, as well as expert in digital educational content.

Digital technology had the benefit of raising children's awareness by adopting a pro-social attitude to their material and use. Such results can be improved by encouraging immersive learning opportunities and maintaining continuity in all learning experiences (Flecha et al., 2020, p. 49). Digital technologies have detrimental impacts on infant development as screen time happens to the detriment of face-to-face experiences. Such results can be reduced by facilitating collaborative experiences that promote the incorporation of new technologies while enabling student engagement through dialogue (Flecha et al., 2020).

Chapter 7: References

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Chapter 8: Annex

8.1. ALIGNMENT BETWEEN DIFFERENT PROPOSALS FOR THE DEVELOPMENT OF CORE COMPETENCES

UNESCO	EUROPEAN UNION	LOE	175/2007 DECREE [BAC]	126/2014 REAL DECREE [LOMCE]	HEZIBERRI 2020	
					Transversal Competences	Disciplinary Competences
Learning to know	Learning to learn	Learning to learn	Learning to learn competence	Learning to learn	Learning to learn and think competence	
Learning to do	Entrepreneurship initiative and spirit	Autonomy and social initiative	Competence for autonomy and social initiative	Entrepreneurship spirit and sense of initiative	Competence for sense of initiative and entrepreneurship spirit	
Learning to live together	Interpersonal and civic competences	Social and citizenship competence	Social and citizenship competence	Social and citizenship competences	Learning to life together	Social and civic competence
Learning to be		Autonomy and social initiative	Competence for autonomy and social initiative		Learning to be competence	
	Mother tongue	Linguistic communication	Linguistic communication competence	Linguistic competence	Competence for verbal, non-verbal and digital communication	Linguistic and literature communication competence
	Foreign language					
	Digital Competence	Information treatment and digital competence	Competence on Information treatment and digital competence	Digital Competence		
	Mathematics, Science and Technology	Mathematics	Mathematics competence	Mathematics competence and basic competence in science and technology		Mathematics Competence
		Knowledge and interaction of physical life	Competence on scientific culture, technology and health			Science competence
						Technology competence
	Culture expression and consciousness	Cultural and artistic competence	Humanistic culture and artistic competence	Culture consciousness and expression		Artistic Competence
						Motor competence

8.2. SUBJECT CODING SCHEME

1. DBH 1

1.1. Basque

1.1.1. Elkarrekin bizi(hi)tza (Living together)

1.1.2. Sentimenduen inbentarioa (Inventory of feelings)

1.1.3. Zaharrak berri (Ancient news)

1.2. Social Sciences

1.2.1. Ni biziko nintzateke (I would live)

1.2.2. Iraganaren puzzlea (Puzzle of the past)

1.2.3. Gaur egungoa demokrazia al da? (Is the current democracy?)

1.3. Natural Sciences

1.3.1. Oinak lurrean, unibertsoan bidaiatzen dugu (Feet on earth, we travel through the universe)

1.3.2. Lurra, etengabe aldatzen ari den planeta (Earth, a planet in constant change)

1.3.3. Bizidun ugari, naturaren opari (Much life, gift of nature)

1.4. Maths

1.4.1. Gauza orok du bere neurria (Everything has its size)

1.4.2. Batzuetan urri, besteetan ugari (Sometimes insufficient, and others too much)

1.4.3. Nolako itxura, halako erabakia (What aspect, such a decision)

1.5. Spanish Language and Literature

1.5.1. Érase una vez y otra vez (Once and again, once and again)

1.5.2. Las lenguas y sus hablantes (Languages and their speakers)

1.5.3. En sus redes (In their networks)

1.6. English

1.6.1. We've got talent!

1.6.2. The secrets of the oceans

1.6.3. The world of inventions

2. DBH 2

2.1. Basque

2.1.1. Literaria (Literature)

2.1.2. Gazte gara gazte (We are young people)

2.1.3. Jalgi hadi plazara! (Go out to squares)

2.2. Social Sciences

2.2.1. Oihala altxatu eta Erdi Aroa azaltzen da (The fabric is lifted and the Middle Ages appears)

2.2.2. Hurbildu bainintzen garai berriko leihoetara (I approached the windows of the new era)

2.2.3. Herriko atarietan etorkizuna zizelkatuz (Carving the future in the portals of the people)

2.3. Natural Sciences

2.3.1. Materia nonahi, birziklatzea ere bai (Matter everywhere, recycling also)

2.3.2. Materialen propietateak, guztion erabilgarri (Properties of materials available for all)

2.3.3. Energiaren beharra, arazo-iturri (The need for energy as a source of problems)

2.4. Maths

2.4.1. ZoriONa, neurri-neurrian da ona (Happiness is good to measure)

2.4.2. Urrutiko eltzea urrez, gerturatu eta lurrez (Pot away in gold, near and earth)

2.4.3. Ez dago handirik txiki barik (There are no big without small)

2.5. Spanish Language and Literature

2.5.1. Con ton y son

2.5.2. La poesía no es un cuento (Poetry is not a tale)

2.5.3. Comunicándonos TIC-TAC (Communicating TIC-TAC)

2.6. English

2.6.1. EUROPE: united in diversity

2.6.2. HEALTHY U

2.6.3. THE PLOT, THE POEM AND THE PLAY

3. DBH 3

3.1. Basque

3.1.1. Gezurrak idazteko artea (Art of lying)

3.1.2. Euskararen lekukoak (Testimonies of the Basque language)

3.1.3. Ika-mika (Polemical controversy)

3.3. Biology and Geology

3.3.1. Zelulatik ekosistemara (From cell to ecosystem)

3.3.2. Osasuntsu hazi, luzaro bizi (Grow healthy, live a lot)

3.3.3. Ekosistema ugari, biosferaren opari (Multiple ecosystems, gift of the biosphere)

3.4. Maths

3.4.1. Zenbakien mezu ezkutua (Hidden Message of Numbers)

3.4.2. Zaku bete letra eta zenbaki, mila galdera-erantzun (Fill a bag with letter and number, a thousand questions and answers)

3.4.3. Ezaugarri eta propietate aldakorretan murgilean (Immersion in variable characteristics and properties)

3.5. Spanish Language and Literature

3.5.1. La mordedura de la literatura (The bite of literatura)

3.5.2. El poder de las líneas (The power of the lines)

3.5.3. El placer de compartir (The pleasure of sharing)

3.6. English

3.6.1. Are you buying this?

3.6.2. Future friend or future foe?

3.6.3. We're all Djs

3.7. Physics and Chemistry

3.7.1. Molekulak, beti dantzan? (Do the molecules always dancing?)

3.7.2. Molekulen orquestra (Orchestra of molecules)

3.7.3. Elektroien zirrara (The emotion of electrons)

3.8. Social Sciences

3.8.1. Etorkizuneko enpresa eratzen (Setting up a sustainable company)

3.8.2. Jarri ahotsa gure ekimenei (Make our voice count)

3.8.3. Izan zaitez munduan ikusi nahi duzun aldaketa (Be the change you wish to see in the world)

4. DBH 4

4.1. Basque

4.1.1. Ohartu gabe heldu gara (We arrived without realizing it)

4.1.2. Baga, biga, higa

4.1.3. Ohartu gabe heldu gara

4.3. Biology and Geology

4.3.1. Lurrean aldaketak, etengabeko historia (Earth changes, a constant history)

4.3.2. Eboluzioaren harira, genetikari begira (The evolution from the genetic perspective)

4.3.3. Lurrean aldaketak, etengabeko historia (Earth changes, a constant history)

4.4. Maths

4.4.1. Hazkunde handi, irabazi ttipi (Great growth, small benefit)

4.4.2. Mugak zabal, erantzun anitz (Broad borders, multiple responses)

4.4.3. Neurtzea eta erlazionatzea, aurreratzea (Measure and relate, advance)

4.5. Spanish Language and Literature

4.5.1. Poesía del XX para poetas del XXI (Poetry of the XX for poets of the XXI)

4.5.2. Mal de lenguas: los prejuicios lingüísticos (Language Evil: Linguistic Prejudice)

4.5.3. ¿Qué opinas? (What do you think?)

4.6. English

4.6.1. The 8th province

4.6.2. Re-creating History

4.6.3. Life between buildings

4.7. Physics and Chemistry

4.7.1. Azeleratu inspirazioaren ibilbidean (Accelerate the journey of inspiration)

4.7.2. Sormenaren indarra (The strength of creativity)

4.7.3. Molekulak, in fraganti (Molecules in fraganti)

4.8. Social Sciences

4.8.1. Garaiak iraultzen (1700-1900) (A time for revolution (1700-1900)

4.8.2. Historiarekin jolasean (Playing with history)

4.8.3. Zu zeu zara Historia (History is you)

8.3. EXERCISE DESCRIPTION IN BASQUE

Zure urruneko lagun berriarekin informazioa trukatzeko gogoa izango duzu, eta, seguruenik, zure ikaskideei lagun hori nor den eta nolakoa den kontatzeko gogoa ere bai.

Gelakideei ahoz azalduko diezu nor den eta nolakoa den zure truke-kidea: izaera, zaletasunak, gustuak… Horretarako, idatz ezazu lagunaren deskribapen labur bat; aurrez aurre ezagutzen ez baduzu ere, adierazi nola irudikatzen duzun, unitatean zehar jaso duzun informazioaren arabera.

Lan hori egiteko, honako urrats hauek egin ditzakezu:

- Hasi baino lehen, jo posta elektronikora, eta eskuratu truke-kideearengandik jaso duzun informazio guztia.
- Zer-nolako informazioa jaso duzu?
- Nola antolatuko duzu informazio hori?
- Zer ezaugarri hautatuko duzu?
- Nola egituratuko duzu ahoz adierazi beharreko deskribapena, zure gelakideek ulertzeko modukoa izan dadin?
- Ez ahaztu deskribapena ahoz azalduko duzula. Ahozko azalpenetan, hitzak zaintzeaz gainera, badaude hainbat alderdi kontuan hartu beharrekoak.

8.4. AMOUNT OF ACTIVITIES IDENTIFIED BY COMPETENCES AND PROFICIENCY LEVEL

Proficiency level / Competences	Foundation	Intermediate	Advanced
1.1	17	113	8
1.2	15	111	29
1.3	42	345	13
2.1	5	1	2
2.2	22	82	18
2.3	4	1	0
2.4	7	156	22
2.5	2	4	0
2.6	0	1	0
3.1	32	231	49
3.2	40	190	6
3.3	5	2	0
3.4	0	0	0
4.2	2	1	0
5.2	0	3	0
5.3	18	55	9
Total	211	1296	156

8.5. AMOUNT OF DIGITAL COMPETENCES ACTIVITIES IDENTIFIED BY SCHOOL YEAR AND PROFICIENCY LEVEL

8.5.1 1.1 BROWSING, SEARCHING AND FILTERING INFORMATION COMPETENCE

School Year / Proficiency Level	1st Year	2nd Year	3rd Year	4th Year	Total
Foundation	15	1	1	0	17
Intermediate	20	20	44	29	113
Advanced	0	0	3	5	8
Total	35	21	48	34	138

8.5.2 1.2 EVALUATING INFORMATION

School Year / Proficiency Level	1st Year	2nd Year	3rd Year	4th Year	Total
Foundation	7	5	3	0	15
Intermediate	20	16	53	22	111
Advanced	7	1	6	15	29
Total	34	22	62	37	155

8.5.3 1.3 STORING AND RETRIEVING INFORMATION

School Year / Proficiency Level	1st Year	2nd Year	3rd Year	4th Year	Total
Foundation	18	19	5	0	42
Intermediate	27	66	41	211	345
Advanced	0	8	5	0	13
Total	45	93	51	211	400

8.5.4 2.1 INTERACTING THROUGH TECHNOLOGIES

School Year / Proficiency Level	1st Year	2nd Year	3rd Year	4th Year	Total
Foundation	3	0	1	1	5
Intermediate	0	0	0	1	1
Advanced	0	0	0	2	2
Total	3	0	1	4	8

8.5.5 2.2 SHARING INFORMATION AND CONTENT

School Year / Proficiency Level	1st Year	2nd Year	3rd Year	4th Year	Total
Foundation	15	5	1	1	22
Intermediate	14	18	38	12	82
Advanced	1	4	6	7	18
Total	30	27	45	20	122

8.5.6 2.3 ENGAGING IN ONLINE CITIZENSHIP

School Year / Proficiency Level	1st Year	2nd Year	3rd Year	4th Year	Total
Foundation	0	0	0	4	4
Intermediate	0	0	0	1	1
Advanced	0	0	0	0	0
Total	0	0	0	5	5

8.5.7 2.4 COLLABORATING THROUGH DIGITAL CHANNELS

School Year / Proficiency Level	1st Year	2nd Year	3rd Year	4th Year	Total
Foundation	6	0	1	0	7
Intermediate	34	36	55	31	156
Advanced	1	0	4	17	22
Total	41	36	60	48	185

8.5.8 2.5 NETIQUETTE

School Year / Proficiency Level	1st Year	2nd Year	3rd Year	4th Year	Total
Foundation	2	0	0	0	2
Intermediate	0	2	2	0	4
Advanced	0	0	0	0	0
Total	2	2	2	0	6

8.5.9 2.6 MANAGING DIGITAL IDENTITY

School Year / Proficiency Level	1st Year	2nd Year	3rd Year	4th Year	Total
Foundation	0	0	0	0	0
Intermediate	0	0	0	1	1
Advanced	0	0	0	0	0
Total	0	0	0	1	1

8.5.10 3.1 DEVELOPING CONTENT

School Year / Proficiency Level	1st Year	2nd Year	3rd Year	4th Year	Total
Foundation	22	7	3	0	32
Intermediate	45	60	42	84	231
Advanced	0	8	32	9	49
Total	67	75	77	93	312

8.5.11 3.2 INTEGRATING AND RE-ELABORATING

School Year / Proficiency Level	1st Year	2nd Year	3rd Year	4th Year	Total
Foundation	14	14	2	10	40
Intermediate	21	40	33	96	190
Advanced	0	1	5	0	6
Total	35	55	40	106	236

8.5.12 3.3 COPYRIGHT AND LICENSES

School Year / Proficiency Level	1st Year	2nd Year	3rd Year	4th Year	Total
Foundation	0	4	1	0	5
Intermediate	0	0	0	2	2
Advanced	0	0	0	0	0
Total	0	4	1	2	7

8.5.13 4.2 PROTECTING PERSONAL DATA

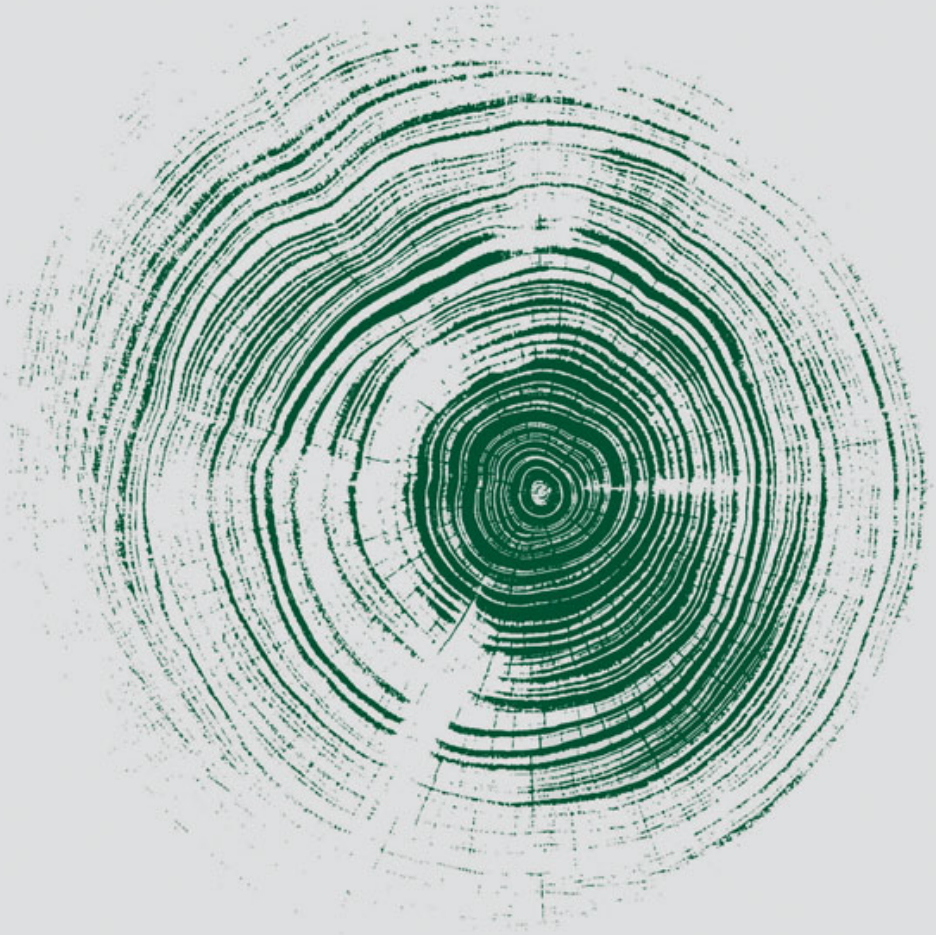
School Year / Proficiency Level	1st Year	2nd Year	3rd Year	4th Year	Total
Foundation	0	2	0	0	2
Intermediate	0	1	0	0	1
Advanced	0	0	0	0	0
Total	0	3	0	0	3

8.5.14 5.2 IDENTIFYING NEEDS AND TECHNOLOGICAL RESPONSES

School Year / Proficiency Level	1st Year	2nd Year	3rd Year	4th Year	Total
Foundation	0	0	0	0	0
Intermediate	0	0	3	0	3
Advanced	0	0	0	0	0
Total	0	0	3	0	3

8.5.15 5.3 INNOVATING AND CREATIVELY USING TECHNOLOGY

School Year / Proficiency Level	1st Year	2nd Year	3rd Year	4th Year	Total
Foundation	5	0	0	13	18
Intermediate	10	7	14	24	55
Advanced	0	6	3	0	9
Total	15	13	17	37	82



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