European Journal of Education Studies
ISSN: 2501 - 1111
ISSN-L: 2501 - 1111
Available online at: www.oapub.org/edu

DOI: 10.46827/ejes.v13i9.6951 Volume 13 | Issue 9 | 2026

THE EVOLUTION OF THE CURRICULUM IN THE "TECHNOLOGY" COURSE IN GREEK SECONDARY EDUCATION SYSTEM: A COMPARATIVE CONTENT ANALYSIS OF THE 2014 AND 2023 CURRICULUM FOR GRADE 8 (2ND YEAR OF GYMNASIUM)

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Abstract:
The reform of school curricula reflects broader educational, technological, and societal transformations that shape the competencies required for 21st century learners. Within this context, the present study examines the evolution of the Greek Technology Curriculum for Grade 8 (2nd class of Gymnasium) through a comparative analysis of the official curricula introduced in 2014 and 2023. The study aims to identify similarities, differences, and underlying educational paradigms while interpreting curriculum reform through contemporary international theoretical frameworks. A qualitative research design was adopted using Qualitative Content Analysis (QCA). The two official curriculum documents were analysed through an iterative coding process combining deductive and inductive approaches. The analytical framework focused on educational philosophy, curriculum aims, pedagogical approaches, technological competencies, Engineering Design, Integrated STEM education, computational thinking, sustainability,

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digital competence, and assessment. The findings reveal that the 2023 curriculum represents a fundamental educational paradigm shift rather than a simple curriculum revision. Compared with the 2014 curriculum, the revised framework moves from content-oriented technology education towards competency-based learning, emphasising inquiry, Engineering Design, interdisciplinary STEM integration, computational thinking, sustainability, collaboration, creativity, digital competence, and formative assessment. Furthermore, the “Technology” course in 8^{th} grade (2^{nd} class of Gymnasium) is reconceptualised from the study of technological artefacts and job descriptions in a modern factory to the design of innovative solutions addressing authentic societal challenges.

Keywords: technology education, curriculum reform, 8th grade, secondary education, qualitative content analysis, STEM, digital competence, Greece

1. Introduction

The rapid technological transformations associated with the Fourth Industrial Revolution have fundamentally reshaped the competencies required of citizens, employees, and future innovators. According to Zogopoulos et al., (2025), the 4th Industrial Revolution involves the integration of digital technologies, artificial intelligence, robotics, and other advanced systems into all aspects of society, including education.

Artificial intelligence, automation, digital fabrication, robotics, additive manufacturing, computational thinking, and sustainable technological development have significantly altered both the nature of work and the educational priorities of contemporary societies. Consequently, technology education has progressively evolved from a subject primarily focused on the acquisition of technical skills into an interdisciplinary field aimed at developing technological literacy, innovation capacity, engineering thinking, computational reasoning, creativity, collaboration, and responsible citizenship (OECD, 2019; UNESCO, 2020; Atman et al., 2007; de Vries, 2016; 2018; Jones 1997; Nikolaou et al., 2025). In the case of Greece, Zogopoulos and Panagiotopoulos, (2025) explored the challenges faced by teachers and school principals in Greece when implementing the digital transformation, in the context of Education 4.0 and the 4th Industrial Revolution, suggesting that the teacher’s role is dynamic and continuously evolving as technology advances, making it essential for them to stay up to date with educational and technological developments.

Within this international context, curricula for the school “Technology” courses have undergone substantial reforms over the last two decades. Contemporary curriculum frameworks increasingly emphasize inquiry-based learning, project-based learning (PBL), engineering design processes, integrated STEM and STEAM education, authentic problem solving, and competence-oriented assessment (Black and William, 2008; 2009) rather than the transmission of isolated technical knowledge. International organizations, including UNESCO, the OECD, the European Commission, and the National Research Council, consistently advocate curricula that prepare learners to address complex societal challenges while simultaneously developing transversal competencies such as critical thinking, systems thinking, creativity, communication, collaboration, digital literacy, and ethical responsibility (OECD, 2019; UNESCO, 2020; Vuorikari et al., 2022; European Commission, 2022).

The "Technology" course in 7,8 and 9 Grades (1st to 3rd Gymnasium in Greek education system) occupies a particularly important position within this educational transformation because it naturally integrates scientific knowledge with practical application as it is mentioned in studies and criteria on several curricula even in different courses around the world (Mahmud, 2018; Gelen and Çetin, 2022; Sahin, 2017; Moyo and Hadebe, 2018). Unlike traditional science education, which often emphasizes conceptual understanding, the "Technology" course in 8th Grade (2nd class of Gymnasium) requires students to employ scientific knowledge for the design, development, evaluation, and improvement of technological solutions. Consequently, technological literacy extends beyond understanding how technologies function; it encompasses the ability to evaluate technological systems critically, appreciate their societal implications, participate in technological innovation, and make informed decisions concerning sustainable development.

The international evolution of technology education and thus the "Technology" courses has been heavily influenced by the emergence of engineering education within compulsory schooling (Kleine et al., 2024). The publication of the Next Generation Science Standards (NGSS) introduced Engineering Design as an equal partner alongside scientific inquiry, fundamentally redefining STEM education (NGSS Lead States, 2013). Rather than treating engineering as an isolated discipline, the NGSS conceptualize engineering design as a systematic process involving problem identification, idea generation, prototyping, testing, optimization, and evaluation. This process-oriented perspective has subsequently influenced curriculum reforms across numerous educational systems worldwide (Priestley et al., 2015; Priestley et al., 2012; van den Akker, 2003).

Parallel developments have occurred through the rapid expansion of Integrated STEM education (Bybee, 2013; Moore et al., 2014). Kelley and Knowles, (2016) argue that authentic STEM learning requires meaningful integration among science, technology, engineering, and mathematics rather than parallel instruction of separate disciplines. Integrated STEM emphasizes interdisciplinary learning experiences centred on authentic real-world problems that require learners to combine knowledge from multiple fields while simultaneously developing creativity, innovation, teamwork, and communication skills. Increasingly, this approach has evolved into STEAM education through the incorporation of Arts as a catalyst for creativity, design thinking, aesthetics, and innovation.

At the same time, educational research has increasingly recognized computational thinking as a fundamental competence for the 21st century (Brennan and Resnick, 2012;

Shute et al., 2017; Wing, 2008). Wing, (2006) defined computational thinking as a universal analytical competence applicable beyond computer science, while subsequent curriculum reforms have integrated algorithmic reasoning, abstraction, decomposition, pattern recognition, and digital modelling into technology education (de Vries, 2018). Computational thinking is now considered one of the foundational literacies required for active participation in digital societies and knowledge economies.

The pedagogical foundations supporting these curriculum reforms are deeply rooted in constructivist learning theories. Piaget's theory of cognitive development emphasizes learners' active construction of knowledge through interaction with their environment, suggesting that meaningful learning occurs when students manipulate objects, investigate phenomena, and reconstruct their mental models through experience. Within technology education, construction activities naturally facilitate assimilation and accommodation processes because learners continuously test and revise their conceptual understanding while designing technological artefacts.

Complementing Piaget's individual constructivism, Vygotsky's sociocultural theory highlights the importance of social interaction, dialogue, collaboration, and scaffolding in cognitive development. The "Technology" classrooms increasingly employ collaborative project work where students negotiate ideas, exchange perspectives, co-construct knowledge, and solve complex problems collectively. Such collaborative learning environments align closely with Vygotsky's concept of the Zone of Proximal Development, whereby learners achieve higher levels of understanding through guided participation and peer interaction. This finding is also supported by a study completed by Egbes, and Ajaja, (2023) whom the result also revealed that there was a significant difference in the mean retention score among students taught with guided discovery, problem-solving instructional strategies and lecture methods.

Constructionism, developed by Papert, (1980), further extends constructivist principles by proposing that learning becomes particularly meaningful when learners construct tangible artefacts that are personally meaningful. Papert, (1980) argued that the creation of physical or digital objects facilitates deeper conceptual understanding because learners externalize their thinking while iteratively refining their ideas. Modern makerspaces, digital fabrication laboratories, robotics education, three-dimensional modelling, and engineering design projects embody this educational philosophy and have become central components of contemporary technology education worldwide since it has been proven to aid students to own and apply their knowledge (Sung and Kelley, 2022; Arokoyu and Wonu, 2019).

Similarly, Project-Based Learning (PBL), extensively developed by Blumenfeld et al., (1991) and Thomas, (2000), has become one of the dominant pedagogical approaches within technology education. PBL situates learning around authentic, complex, and often ill-defined problems requiring sustained inquiry, collaborative investigation, design thinking, iterative improvement, and public presentation of outcomes. Numerous empirical studies demonstrate that project-based learning enhances students' conceptual understanding, motivation, self-regulation, communication skills, and technological creativity.

Recent curriculum reforms have also been strongly influenced by broader international policy frameworks concerning sustainable development and future competencies. UNESCO's framework for education for sustainable development emphasizes the integration of sustainability principles, responsible innovation, environmental awareness, ethical decision-making, and global citizenship across school Curricula (UNESCO, 2017). Likewise, the OECD Learning Compass 2030 conceptualizes education as supporting learners in developing agency, creating new value, reconciling tensions and dilemmas, and assuming responsibility for their actions in increasingly complex societies (OECD, 2019).

Digital transformation has introduced additional curriculum priorities. The European Digital Competence Framework (DigComp) and DigCompEdu identify digital literacy, information management, communication, content creation, problem solving, digital safety, and responsible technology use as essential competencies for both learners and educators (European Commission, 2022). The "Technology" courses therefore increasingly incorporate digital tools not merely as instructional resources but as integral components of technological design and innovation processes.

Within this broader international landscape, Greek compulsory education has also experienced significant curriculum reform. The Curriculum for the "Technology" course in Gymnasium introduced in 2014 (Government Gazette of the Hellenic Republic, 2014) represented an important modernization of the traditional subject by emphasizing individual technological projects, construction activities, technological reports, and experiential learning. Students were encouraged to investigate technological developments, construct physical models, collect information from diverse sources, and present their findings through progressively developed individual projects. Nevertheless, the curriculum remained primarily organized around technological sectors, individual construction activities, and content-oriented objectives.

The Curriculum published in 2023 (Government Gazette of the Hellenic Republic, 2023) represents a substantially different educational philosophy. Rather than focusing predominantly on technological products, it conceptualizes technology as an interdisciplinary process integrating science, engineering, mathematics, computational thinking, arts, and authentic problem solving. The curriculum explicitly introduces integrated STEAM education, Engineering Design, computational thinking, Responsible Research and Innovation (RRI), inclusion, sustainability, 21st century competencies, and holistic learning as central organizing principles, since, according to Cunningham and Carlsen, (2014), children are natural engineers since they tinker with the natural world and the designed world too. Furthermore, learning objectives are reformulated around competencies, scientific and engineering practices, collaborative problem solving, and authentic societal challenges instead of isolated technical knowledge.

These substantial conceptual changes raise important research questions regarding the evolution of technology education and the "Technology" course in 8th Grade (2nd class of Gymnasium) in Greece. Although both curricula pursue technological literacy, they appear to reflect different educational paradigms concerning the nature of technology, learning, curriculum design, assessment, and student participation. The transition from a product-oriented curriculum towards a competence-based, interdisciplinary, and sustainability-oriented framework deserves systematic investigation through rigorous curriculum analysis (Sterling, 2001).

Despite the educational significance of these reforms, comparatively few studies have systematically examined how the Greek Curriculum for the "Technology" courses has evolved between the 2014 and 2023 curriculum frameworks (Leontopoulos et al., 2026). Existing discussions primarily describe curriculum changes without employing established qualitative methodologies capable of revealing underlying conceptual transformations, pedagogical shifts, and emerging educational priorities. Consequently, there remains a gap in the literature concerning the extent to which the new curriculum aligns with international developments in technology education and contemporary learning sciences.

To address this gap, the present study conducts a Qualitative Content Analysis (QCA) of the "Technology" course Curriculum for Grade 8 (2nd class of Gymnasium) by systematically comparing the 2014 and 2023 Curriculum documents. Rather than limiting the analysis to descriptive similarities and differences, the study identifies thematic categories, conceptual patterns, pedagogical orientations, and underlying educational philosophies embedded within both curriculum frameworks. The analysis further interprets these findings through internationally recognised theoretical perspectives, including constructivism (Piaget, 1972), sociocultural learning (Vygotsky, 1978), constructionism (Papert, 1980), Project-Based Learning (Blumenfeld et al., 1991; Thomas, 2000), Integrated STEM (Kelley and Knowles, 2016), Engineering Design (NGSS, 2013), the OECD Learning Compass 2030, UNESCO's Education for Sustainable Development framework (OECD, 2019), Responsible Research and Innovation (RRI), and the European DigComp and DigCompEdu frameworks (Punie, and Redecker, 2017; European Commission, 2017; European Commission, 2022).

Ultimately, this study seeks to contribute both to curriculum research and to technology education by providing a theoretically grounded and internationally contextualised interpretation of the evolution of the Greek "Technology" course Curriculum. Through a systematic comparison of the two official curriculum documents, the research aims to illuminate how educational priorities have shifted over the past decade and to evaluate the extent to which the 2023 Curriculum reflects contemporary international trends in technology, engineering, STEM education, digital competence, and sustainable development.

2. Theoretical framework

2.1 The evolution of "Technology" education in the 21st century

The "Technology" course in 8th Grade (2nd class of Gymnasium) and technology education have experienced a profound conceptual transformation over the last three decades. Traditionally, curricula for the "Technology" course in schools have primarily emphasized the acquisition of technical knowledge, manual skills, and familiarity with industrial production processes. The "Technology" course in 8th Grade (2nd class of Gymnasium) was frequently viewed as a collection of tools, machines, materials, and manufacturing techniques that students needed to understand in order to participate effectively in industrial society. This product-oriented perspective reflected the economic priorities of the 20th century, where industrial production and technical competence constituted the primary objectives of technology education.

During the last two decades, however, globalization, digital transformation, climate change, and the emergence of knowledge-based economies have fundamentally altered the role of technology within education. Technology is no longer understood merely as the production of artefacts but as an interdisciplinary process involving innovation, systems thinking, sustainability, computational reasoning, and responsible decision-making (Sterling, 2001). The educational system should support and develop not only the above-mentioned characteristics but also creative since it is a teaching-learning method, preparing students to acquire not only knowledge but also competences, abilities and skills (Nikolaou et al., 2025). Consequently, contemporary curricula increasingly emphasize technological literacy rather than technological knowledge alone.

The concept of technological literacy has become central within international curriculum reforms. According to the International Technology and Engineering Educators Association (ITEEA, 2020), technologically literate individuals are capable of understanding technological systems, evaluating their societal impacts, solving authentic technological problems, making informed decisions, and participating responsibly in technological innovation.

This broader conception is reflected in international educational policy. UNESCO, (2020) argues that technology education should contribute not only to economic competitiveness but also to sustainable development, environmental responsibility, democratic participation, and social justice. Similarly, the OECD Learning Compass 2030 identifies innovation, agency, collaboration, systems thinking, and responsibility as essential competencies for future citizens (OECD, 2019).

Within this context, curriculum reforms increasingly prioritize authentic problem solving over factual knowledge acquisition. The "Technology" course in 8th Grade (2nd class of Gymnasium) and technology education therefore becomes a learning environment where students investigate real-world problems, develop alternative solutions, evaluate competing ideas, and continuously improve technological designs through iterative processes.

This international evolution provides an important interpretative lens for understanding the transition between the Greek Curriculum of the "Technology" course of 2014 and that of 2023. While the former primarily reflects technological literacy through individual construction projects and technological investigation, the latter incorporates broader international developments by integrating engineering, computational thinking, sustainability, interdisciplinary learning, and 21st century competencies being in accordance with Dym et al., (2005) conclusions.

2.2 Constructivism and technology learning

The theoretical foundations of contemporary technology education are deeply rooted in constructivist theories of learning. Constructivism assumes that knowledge is actively constructed by learners through interaction with their physical and social environment rather than transmitted directly by teachers. Jean Piaget's cognitive constructivism proposes that learning occurs through continuous processes of assimilation and accommodation as learners reorganize their cognitive structures while interacting with new experiences (Piaget, 1972). Technology education naturally embodies these principles because students engage directly with materials, tools, prototypes, and technological systems. Every design decision requires learners to compare existing knowledge with emerging evidence, revise misconceptions, and reconstruct conceptual understanding.

The design and construction of technological artefacts therefore represent ideal constructivist learning environments. Students formulate hypotheses, test alternative solutions, evaluate outcomes, identify design limitations, and iteratively refine their products. Learning emerges from the interaction between conceptual understanding and practical experimentation rather than from passive reception of information (Mahmud, 2018).

The 2014 Greek Curriculum already incorporates several constructivist characteristics through individual technological projects and experiential construction activities. Students investigate technological objects, collect information from multiple sources, construct models, prepare written reports, and present their findings. Nevertheless, constructivism remains primarily associated with individual learning experiences and teacher-guided project development.

By contrast, the 2023 Curriculum extends constructivist principles considerably by emphasizing inquiry-based learning, engineering design, authentic problem solving, interdisciplinary knowledge integration, and iterative design processes. Learning becomes increasingly competence-oriented rather than product-oriented, reflecting more recent interpretations of constructivist pedagogy.

2.3 Sociocultural learning theory

Whereas Piaget emphasized individual cognitive development, Lev Vygotsky highlighted the social origins of learning. According to sociocultural theory, knowledge develops through interaction, dialogue, collaboration, and participation in meaningful social practices (Vygotsky, 1978).

The "Technology" courses and technology education provide particularly fertile conditions for sociocultural learning because engineering design rarely occurs individually in professional practice. Students collaborate, negotiate ideas, exchange perspectives, evaluate alternative solutions, and jointly construct technological artefacts. Such collaborative learning environments promote higher-order thinking while enabling learners to benefit from peer scaffolding and teacher guidance thus, teacher must be able to apply several and different teaching methods (Chu, 2020) and modern digital tools such as computer, internet use and artificial intelligence (AI) (Sed et al., 2025; Pesce and Blanco, 2024; Zogopoulos et al., 2026; Pikkarainen et al., 2021). Regarding the reception of AI in the educational field, particularly the use of ChatGPT has varied between enthusiasm and skepticism, sparking a series of controversies and challenges in response to their emergence within the educational context. For this reason, Zogopoulos et al., (2026) suggest that enhancing teacher training and readiness emerges as a key prerequisite for a pedagogically responsible use of AI in schools. AI tools can be a real support tool for students and teachers and not a threat. Thus, students highlighted the importance of working with these tools from the beginning of their training, with the mediation of a teacher and a specialist in these new information technologies (Pesce and Blanco, 2024).

Central to Vygotsky's theory is the concept of the Zone of Proximal Development (ZPD), referring to tasks learners cannot accomplish independently but can successfully complete with appropriate support. Contemporary technology classrooms increasingly employ collaborative engineering projects that position teachers as facilitators rather than transmitters of knowledge.

The shift observed in the Greek curriculum reflects this theoretical evolution. While the 2014 curriculum predominantly emphasizes individual technological projects, the 2023 curriculum explicitly promotes collaborative inquiry, authentic societal challenges, interdisciplinary teamwork, and collective engineering practices. This represents a movement towards sociocultural conceptions of learning that are consistent with international STEM education reforms.

2.4 Constructionism: Learning through designing

Perhaps no educational theory has influenced modern technology education more profoundly than Seymour Papert's Constructionism. Extending Piaget's constructivism, Papert, (1980) argued that learners develop deeper conceptual understanding when they create meaningful public artefacts. Constructionism proposes that learning becomes especially powerful when students design, build, program, fabricate, model, or otherwise externalize their thinking through tangible objects. Modern makerspaces, robotics laboratories, three-dimensional modelling software, digital fabrication technologies, and engineering design projects all reflect constructionist principles. Within constructionist environments, technological artefacts function simultaneously as learning products and cognitive tools. Students think through design, communicate through prototypes, and continuously refine ideas through iterative construction.

The Greek curriculum of 2014 strongly reflects constructionist traditions through the emphasis placed on model construction and technological projects. However, the construction process primarily serves as the final product of learning.

The 2023 curriculum extends this philosophy by conceptualizing design itself as the learning process. Engineering Design becomes not simply a means of producing an artefact but a framework for acquiring interdisciplinary knowledge, solving authentic problems, and developing transferable competencies.

2.5 Project-based learning

Project-Based Learning (PBL) constitutes one of the dominant pedagogical approaches in technology education. Blumenfeld et al., (1991) and Thomas, (2000) describe PBL as sustained inquiry centred on authentic, complex problems requiring investigation, collaboration, design, reflection, and public presentation. Unlike conventional project work, authentic PBL requires learners to formulate questions, collect evidence, evaluate information, construct prototypes, revise solutions, and communicate outcomes to authentic audiences. The project therefore becomes the vehicle through which conceptual understanding develops.

The 2014 curriculum employs projects primarily as instructional products. Students individually investigate a technological topic, construct a model, prepare documentation, and present their work.

Conversely, the 2023 curriculum reframes projects as vehicles for interdisciplinary inquiry and engineering problem-solving. Projects increasingly involve authentic societal contexts, sustainability issues, collaborative design, scientific practices, computational thinking, and iterative optimization. Consequently, project work evolves from a method of demonstrating learning into a process for generating learning itself.

2.6 Engineering design and integrated STEM education

One of the most significant developments in international technology education has been the emergence of Engineering Design as the organizing principle of STEM education. The Next Generation Science Standards (NGSS) identify Engineering Design as one of the fundamental scientific practices alongside scientific inquiry (NGSS Lead States, 2013). Engineering Design includes identifying problems, establishing design criteria, generating multiple solutions, constructing prototypes, evaluating performance, optimizing designs, and communicating solutions (Cunningham and Kelly, 2017; Kelly and Cunningham, 2019).

Rather than separating science from technology, engineering design integrates conceptual understanding with practical application. Scientific knowledge becomes meaningful because it is employed to solve authentic technological challenges.

Closely related is the framework of Integrated STEM education proposed by Kelley and Knowles, (2016). Integrated STEM rejects disciplinary isolation and instead promotes interdisciplinary learning experiences where scientific, technological, mathematical, and engineering concepts interact continuously throughout authentic design challenges.

The transition observed in the Greek curriculum strongly reflects these international developments. Engineering Design occupies only a marginal position in the 2014 curriculum, whereas it constitutes the central pedagogical framework of the 2023 curriculum. Likewise, STEAM education, interdisciplinary integration, computational thinking, and authentic engineering practices become defining characteristics of the new curriculum.

2.7 Education for sustainable development, innovation and digital competence

Contemporary technology education increasingly incorporates sustainability, responsible innovation, and digital competence as essential educational objectives. UNESCO's Education for Sustainable Development (ESD) framework advocates empowering learners to address environmental, economic, and social challenges through systems thinking, collaboration, ethical reasoning, and future-oriented decision making (UNESCO, 2020). Technology education provides a natural context for these objectives because technological innovation directly influences sustainable development.

Similarly, the European concept of Responsible Research and Innovation (RRI) emphasizes anticipation, inclusion, ethics, sustainability, and public engagement throughout technological development. Students are therefore encouraged not merely to create technological solutions but also to evaluate their broader societal consequences.

Digital competence represents an additional pillar of contemporary curricula. According to DigComp and DigCompEdu, digital literacy extends beyond technical skills to include information evaluation, communication, collaboration, digital content creation, problem solving, cybersecurity, and responsible participation in digital society (European Commission, 2022; 2017).

These international priorities are clearly reflected in the 2023 Greek Curriculum for the "Technology" course, which explicitly incorporates Responsible Research and Innovation, inclusion, computational thinking, interdisciplinary STEAM education, authentic societal problems, and sustainability as fundamental curriculum dimensions. Such concepts are largely absent from the 2014 curriculum, indicating a substantial paradigm shift towards internationally aligned, competence-based the "Technology" courses and technology education.

2.8 Conceptual framework of the study

The present study is founded on the premise that curriculum documents are not merely administrative or regulatory texts but constitute pedagogical artefacts that embody educational philosophies, epistemological assumptions, and societal expectations concerning teaching and learning. Consequently, curriculum change extends beyond modifications in learning objectives or instructional content; it reflects broader transformations in conceptions of knowledge, learning, technological literacy, and citizenship. From this perspective, the comparison between the 2014 and 2023 Greek Curricula for the "Technology" courses is approached as an investigation of curriculum evolution through the lens of qualitative curriculum research rather than as a simple descriptive comparison of official documents.

The conceptual framework developed for this study integrates three complementary analytical dimensions: (a) curriculum theory, (b) contemporary learning theories, and (c) international policy frameworks for technology and STEM education. Together, these dimensions provide the interpretative foundation for the qualitative content analysis and support a theoretically grounded explanation of the similarities and differences identified between the two curriculum documents.

The first-dimension concerns curriculum theory, according to which curricula represent socially and historically constructed educational models that evolve in response to changing societal, technological, and economic conditions (Kelly, 2009). Curriculum reform therefore reflects changing assumptions about what knowledge is considered valuable, how learning occurs, what competencies future citizens require, and how educational success should be evaluated. Within this perspective, curriculum documents are interpreted not only according to their explicit learning objectives but also through their implicit educational philosophy, pedagogical assumptions, and underlying conceptions of technology education.

The second dimension is grounded in constructivist and sociocultural theories of learning, which collectively explain how students develop technological understanding through active engagement with authentic problems, collaborative inquiry, and reflective practice. Piaget's constructivism provides the theoretical basis for understanding learning as an active process of cognitive reconstruction, while Vygotsky's sociocultural theory emphasizes the collaborative nature of knowledge construction and the importance of dialogue, scaffolding, and participation in meaningful learning communities (Piaget, 1972; Vygotsky, 1978). These theories are complemented by Papert's Constructionism, which conceptualizes technological artefact construction as both the product and the medium of learning (Papert, 1980). Together, these perspectives support the interpretation of technology education as an experiential and inquiry-oriented discipline in which students construct conceptual understanding through designing, building, evaluating, and improving technological solutions.

The third dimension incorporates the major international frameworks that have shaped technology education during the last decade. Integrated STEM education (Kelley and Knowles, 2016), the Engineering Design process introduced by the NGSS (NGSS Lead States, 2013), the OECD Learning Compass 2030 (OECD, 2019), UNESCO's Education for Sustainable Development framework (UNESCO, 2020), Responsible Research and Innovation (European Commission, 2015), and the DigComp and DigCompEdu frameworks (European Commission, 2022; 2017) collectively describe the competencies expected from learners in contemporary societies. Rather than viewing technology education as a subject concerned solely with technical knowledge, these international frameworks emphasize interdisciplinary problem-solving, sustainability, innovation, computational thinking, ethical responsibility, digital competence, creativity, collaboration, and lifelong learning. These frameworks therefore provide the international benchmark against which the Greek curriculum reform can be interpreted. Drawing upon these theoretical perspectives, the present study conceptualizes curriculum evolution as occurring across five interrelated dimensions that collectively describe the educational transformation of technology education.

The first dimension concerns the educational philosophy underlying each curriculum. This includes the overall purpose of technology education, the conceptualization of technological literacy, the role attributed to technology within society, and the balance between disciplinary knowledge and competence development. Changes identified within this dimension indicate broader shifts in educational ideology rather than isolated modifications of curriculum content.

The second dimension examines the pedagogical orientation of the curriculum. Particular attention is given to instructional approaches, inquiry-based learning, project-based learning, engineering design, collaborative learning, authentic problem solving, and the changing roles of teachers and students. This dimension allows the study to investigate whether curriculum reform reflects the transition from teacher-directed instruction towards learner-centred pedagogies advocated by contemporary educational research.

The third dimension focuses on the knowledge and competencies promoted within each curriculum. Rather than considering learning objectives as isolated statements, the analysis explores the extent to which curricula emphasize conceptual understanding, procedural knowledge, technological practices, computational thinking, creativity, communication, collaboration, digital literacy, systems thinking, and engineering habits of mind. This perspective reflects the international transition from content-based curricula towards competency-based educational frameworks.

The fourth dimension concerns the social and ethical context of technology education. Contemporary international literature increasingly recognizes that technological innovation cannot be separated from sustainability, environmental responsibility, ethical decision-making, inclusion, and responsible citizenship. Accordingly, the analysis examines the extent to which both curricula integrate principles associated with Education for Sustainable Development (ESD), Responsible Research and Innovation (RRI), and the United Nations Sustainable Development Goals (SDGs).

Particular emphasis is placed on whether technology is presented as a purely technical endeavour or as a socially embedded human activity with significant environmental, cultural, and ethical implications.

The fifth dimension addresses the assessment philosophy embedded within the curriculum documents. Assessment represents one of the clearest indicators of educational priorities because it determines which forms of learning are valued and recognized. The analysis therefore investigates whether assessment primarily emphasizes the evaluation of final technological products or whether it adopts broader formative approaches that recognize inquiry, collaboration, creativity, design processes, reflection, and continuous improvement.

These five dimensions collectively constitute the analytical framework through which the curriculum documents are examined. Importantly, they were not imposed arbitrarily but were derived through an iterative dialogue between curriculum theory, the international literature on technology education, and the preliminary examination of the two official curriculum documents. This approach is consistent with directed qualitative content analysis, in which initial coding categories emerge deductively from established theoretical frameworks while remaining sufficiently flexible to accommodate new themes arising inductively from the data (Mayring, 2014; Schreier, 2012). Table 1 illustrates the conceptual framework guiding the present investigation.

Table 1: Conceptual framework guiding the qualitative content analysis

International Educational Frameworks	Learning Theories	Curriculum Theory	Analytical Categories
OECD Learning Compass 2030	Piaget	Curriculum Evolution	Educational Philosophy
UNESCO ESD	Vygotsky	Competency-Based Curriculum	Pedagogical Orientation
NGSS Engineering Design	Papert	Curriculum Transformation	Knowledge and Competencies
Integrated STEM	Bruner	Technology Education	Sustainability, Ethics and RRI
DigComp / DigCompEdu	Blumenfeld & Thomas (PBL)	Curriculum Innovation	Assessment Philosophy

Based on this conceptual framework, the present study assumes that curriculum reform can be interpreted as a multidimensional educational transformation encompassing changes in educational philosophy, pedagogical practices, technological knowledge, learner competencies, and assessment approaches in contrast with the findings of Chiou et al., (2025) study in which the findings revealed that Greek secondary education teachers generally use both traditional and alternative assessment tools, demonstrating a marked preference for traditional ones. Consequently, the comparison between the 2014 and 2023 curricula seeks not merely to identify textual differences but to reveal the underlying paradigm shift in Greek "Technology" course of 8th Grade.

This perspective aligns with contemporary qualitative curriculum research, which views curriculum documents as expressions of broader educational change rather than isolated policy texts. By integrating international theoretical frameworks with systematic qualitative content analysis, the study aims to provide a comprehensive explanation of how the Greek Curriculum for the "Technology" courses has evolved in response to global developments in STEM education, digital transformation, sustainability, and 21st century competencies. The conceptual framework thus serves as the interpretative bridge between the theoretical foundations presented in this section and the methodological procedures described in the following section, ensuring that the subsequent analysis is theoretically coherent, analytically rigorous, and internationally contextualized.

3. Methodology

3.1 Research design

The present study adopts a qualitative comparative research design employing Qualitative Content Analysis (QCA) to examine the evolution of the "Technology" course Curriculum for Grade 8 (B class of Gymnasium) in Greece. Rather than treating curriculum documents as neutral policy texts, this study conceptualizes them as educational artefacts that reflect underlying pedagogical philosophies, epistemological assumptions, and societal expectations regarding technology education. Qualitative Content Analysis was selected because it enables the systematic interpretation of textual data while simultaneously identifying explicit content and latent meanings embedded within official curriculum documents (Mayring, 2014; Schreier, 2012). Unlike purely descriptive document analysis, QCA facilitates the identification of conceptual patterns, educational priorities, and ideological shifts across curriculum reforms. The study follows a comparative qualitative document analysis, in which the official Curriculum of the "Technology" course for 8th grade published in the Government Gazette of the Hellenic Republic 2406/2014 is systematically compared with the revised curriculum introduced through the Government Gazette of the Hellenic Republic 417/2023. Both documents constitute the official national curriculum for secondary education and therefore represent authoritative policy texts defining the aims, learning objectives, pedagogical principles, and assessment approaches adopted in Greek compulsory education.

The methodological orientation combines deductive and inductive qualitative analysis. Deductive coding was guided by established theoretical frameworks in technology education, STEM education, curriculum theory, and learning sciences, whereas inductive coding allowed additional themes emerging directly from the curriculum documents to be incorporated into the analytical framework. This hybrid approach is widely recommended in contemporary qualitative curriculum research because it balances theoretical sensitivity with openness to unexpected findings (Mayring, 2014).

3.2 Research aim

The principal aim of the study is to investigate how the educational philosophy, pedagogical orientation, curriculum structure, technological competencies, and assessment approaches embedded within the Greek Curriculum for the “Technology” course for 8th grade have evolved between the 2014 and 2023 curriculum reforms. Rather than identifying only textual similarities and differences, the study seeks to interpret curriculum evolution within the broader context of international developments in technology education, Integrated STEM, Engineering Design, computational thinking, sustainability education, and competence-based curriculum reform.

3.3 Research questions

The study is guided by the following research questions presented in Table 2:

Table 2: Research questions

Research question 1:	How has the educational philosophy of the Curriculum for the “Technology” course for Grade 8 evolved between the 2014 and 2023 curriculum reforms?
Research question 2:	What changes can be identified regarding learning objectives, technological competencies, and expected student outcomes?
Research question 3:	How have pedagogical approaches shifted with respect to inquiry-based learning, Project-Based Learning, Engineering Design, collaborative learning, and computational thinking?
Research question 4:	To what extent does the 2023 curriculum align with contemporary international frameworks, including NGSS, Integrated STEM, OECD Learning Compass 2030, UNESCO Education for Sustainable Development, Responsible Research and Innovation, DigComp, and DigCompEdu?
Research question 5:	What broader educational paradigm shift can be identified through the comparison of the two curriculum documents?

These research question’s structure both the coding process and the interpretation of findings presented in the Results and Discussion sections.

3.5 Units of analysis

Following recommendations by Krippendorff, (2019) and Schreier, (2012) multiple units of analysis were employed. The recording unit consisted of meaningful curriculum statements, including: curriculum aims, learning objectives, expected learning outcomes, competency descriptions, pedagogical recommendations, assessment guidelines, thematic units, and examples of learning activities.

The context unit corresponded to the broader curriculum section in which each statement appeared, allowing interpretation within its pedagogical and curricular context. This multi-level approach minimizes fragmentation of the data while preserving the educational meaning of each curriculum statement.

3.6 Development of the coding scheme

The coding framework was developed through an iterative process involving three successive stages.

Stage 1: Deductive Category Development. Initial coding categories were derived from: curriculum theory; technology education literature; Integrated STEM literature; Engineering Design literature; constructivist learning theories; OECD Learning Compass 2030; UNESCO Education for Sustainable Development; DigComp; DigCompEdu; Responsible Research and Innovation.

Stage 2: Pilot Coding. Both curriculum documents were independently examined in order to identify additional themes not sufficiently represented by the theoretical framework. Several new categories emerged inductively, including: interdisciplinary integration, sustainability orientation, authentic societal problems, engineering practices, computational thinking, systems thinking, learner agency, formative assessment.

Stage 3: Category Refinement. The preliminary categories were continuously compared, merged, reorganized and refined until conceptual saturation was achieved. The final coding framework consisted of five overarching analytical dimensions, eighteen thematic categories, and forty-seven individual codes presented in Table 3.

Table 3: Coding framework employed in the qualitative content analysis

Analytical Dimension	Categories
Educational Philosophy	Technology literacy, curriculum purpose, learner-centred orientation, interdisciplinarity
Pedagogical Orientation	Inquiry learning, Project-Based Learning, Engineering Design, collaborative learning, experiential learning
Knowledge and Competencies	Scientific knowledge, technological knowledge, computational thinking, creativity, innovation, communication, collaboration, systems thinking
Sustainability and Society	Sustainable development, Responsible Research and Innovation, ethics, inclusion, SDGs
Assessment	Product assessment, process assessment, formative assessment, authentic assessment

3.7 Coding procedure

Coding followed the systematic procedure proposed by Mayring, (2014). Initially, both curriculum documents were read repeatedly to achieve immersion in the data. Subsequently, all meaningful curriculum statements were segmented into coding units. Each unit was assigned one or more thematic codes according to the coding manual. Whenever new concepts emerged that were not represented adequately by the existing coding framework, the coding scheme was revised following constant comparison procedures. After completion of the first coding cycle, all coded extracts were reviewed again to ensure conceptual consistency across categories. Finally, categories were grouped into broader themes representing the educational transformation of the curriculum. This iterative procedure ensured that both manifest and latent curriculum meanings were systematically identified.

3.8 Trustworthiness

Educational research literature seems to highlight the use of different research methods, but there appear to be three main research strategies widely used and discussed. These are experiments, surveys and case studies (Al-Sinani et al., 2022). To enhance methodological rigour, the study adopted the four criteria of qualitative trustworthiness (credibility, dependability, confirmability and transferability) proposed by Lincoln and Guba, (1985) and applied by several studies such as by Loh, (2013). Although the study focuses on the Greek curriculum, the analytical framework is grounded in internationally recognised educational theories, allowing comparison with curriculum reforms implemented in other educational systems.

3.9 Ethical considerations

The study analyses publicly available governmental documents. Consequently, no human participants were involved, no personal data were collected, and institutional ethical approval was not required. Nevertheless, the analysis adhered to principles of academic integrity, transparency, methodological rigor, and faithful representation of the curriculum documents.

3.10 Data analysis

The analysis followed six sequential phases: Familiarization with the curriculum documents; identification of meaningful textual units; initial deductive coding; inductive refinement of categories; comparative thematic analysis and interpretation through international theoretical frameworks. The final stage involved synthesizing the qualitative findings within the broader literature on technology education, STEM education, engineering design, sustainability education, digital competence, and curriculum reform. This interpretative process enabled the identification of broader paradigm shifts extending beyond explicit curriculum modifications.

3.11 Coding matrix and analytical evidence

To enhance methodological transparency and analytical rigour, the findings of the qualitative content analysis are presented through a coding matrix illustrating the progression from raw curriculum statements to descriptive codes, thematic categories, analytical dimensions, and theoretical interpretation. Following the recommendations of Schreier, (2012); Mayring, (2014); and Krippendorff, (2019), the coding process was conducted iteratively, allowing both deductive and inductive categories to emerge throughout successive coding cycles.

Rather than treating curriculum reform as a collection of isolated textual modifications, the coding framework sought to identify recurring conceptual patterns reflecting broader educational transformations. Each meaningful curriculum statement was therefore coded according to its educational function, pedagogical orientation, competency focus, and underlying curriculum philosophy.

The analytical framework consisted of three hierarchical levels: a) Open codes, representing individual curriculum statements; b) Thematic categories, grouping conceptually related codes; and c) Analytical dimensions, describing broader patterns of curriculum evolution. This hierarchical coding structure enabled systematic comparison between the two curriculum documents while preserving the contextual meaning of individual curriculum statements. The coding matrix demonstrates that the analytical categories presented in the Results section emerged directly from the curriculum documents rather than being imposed exclusively by the theoretical framework. This strengthens the credibility of the analysis by illustrating the explicit relationship between empirical evidence and theoretical interpretation. Moreover, the coding hierarchy revealed recurring conceptual clusters that consistently differentiated the two curriculum documents.

3.12 Frequency analysis of the coding categories

Although the present investigation follows a qualitative research design, the frequency of thematic codes was calculated to support interpretation and identify dominant curriculum orientations. Frequency counts were not employed for statistical inference but as an additional descriptive indicator of conceptual emphasis within each curriculum document. The analysis revealed notable differences in the distribution of thematic categories between the two curricula. Table 4 presents the relative emphasis of coding categories identified through qualitative content analysis and should be interpreted as descriptive rather than quantitative.

Table 4: Relative emphasis of coding categories across the two Curricula

Coding Category	Curriculum 2014	Curriculum 2023	Trend
Technological Knowledge	High	Medium	↓
Practical Construction	Very High	Medium	↓
Inquiry	Low	Very High	↑
Engineering Design	Very Low	Very High	↑↑
Collaboration	Medium	Very High	↑
Creativity	Low	High	↑
Computational Thinking	Absent	High	↑↑
Sustainability	Low	Very High	↑↑
Responsible Innovation	Absent	High	↑↑
Digital Competence	Low	Very High	↑↑
Formative Assessment	Very Low	High	↑↑

4. Results

4.1 Evolution of the educational philosophy

One of the most significant findings emerging from the qualitative content analysis concerns the profound transformation of the educational philosophy underpinning the Curriculum of the "Technology" course for Grade 8 (Table 5). Although both curriculum documents pursue the development of technological literacy, they conceptualize technology education through substantially different educational paradigms.

The 2014 curriculum adopts a technology-centred philosophy that views technological education primarily as a means of understanding technological artefacts and developing practical construction skills through individual technological projects. The curriculum is organised around technological sectors and encourages students to select a technological object, investigate its historical evolution, collect information from multiple sources, construct a physical model, and prepare an accompanying written report. Learning is therefore largely structured around the investigation and construction of technological products, while technological knowledge is presented as the principal educational objective. The analysis further indicates that the educational philosophy of the 2014 curriculum reflects the tradition of the "Technology" course in 8th Grade (2nd class of Gymnasium) established during the late 20th century, in which technological literacy is associated with understanding technological systems, recognising their historical development, and acquiring practical construction skills. The curriculum places considerable emphasis on the relationship between technology and society, including references to environmental impacts, industrial development, technological innovation, transportation, energy systems, agricultural technologies, manufacturing, and communication technologies. Nevertheless, these thematic areas primarily function as domains of technological knowledge rather than as interdisciplinary contexts for competency development.

In contrast, the 2023 curriculum introduces a markedly different educational philosophy. Technology is no longer treated as an independent body of technical knowledge but as an interdisciplinary field that integrates science, engineering, mathematics, digital technologies, sustainability, creativity, and innovation, as it is mentioned in several research studies (Sterling, 2001; Wiek et al., 2011; Nikolaou et al., 2025). The curriculum adopts a competency-based perspective in which technological learning is organised around authentic problems requiring inquiry, engineering design, collaboration, reflection, and continuous improvement. Rather than asking students simply to understand existing technologies, the curriculum encourages them to become active designers of technological solutions capable of responding to contemporary societal challenges.

A notable conceptual shift concerns the definition of technological literacy itself. Within the 2014 curriculum, technological literacy primarily refers to understanding technology and constructing technological artefacts. In the 2023 curriculum, however, technological literacy expands to include creativity, computational thinking, systems thinking, responsible innovation, sustainability, digital competence, collaboration, communication, and engineering practices. Consequently, technology education evolves from a discipline focused predominantly on technological products towards one centred on technological processes and competencies.

This transformation closely reflects international developments in technology education during the last decade. According to the OECD Learning Compass 2030 (OECD, 2019), future-oriented curricula should prepare learners not only to acquire knowledge but also to create new value, reconcile competing perspectives, and assume responsibility for their decisions. Similarly, UNESCO, (2020) argues that the "Technology" courses and technology education should contribute to sustainable development, responsible citizenship, and ethical technological innovation. The educational philosophy embedded within the 2023 curriculum demonstrates strong alignment with these international priorities, whereas the 2014 curriculum primarily reflects earlier conceptions of technological literacy associated with industrial and technical education.

Another important difference identified through the analysis concerns the learner's role. The 2014 curriculum conceptualises students primarily as constructors of technological models who progressively develop practical skills through individual investigation and fabrication. Teacher guidance remains central throughout the learning process, while assessment largely focuses on the quality of the final technological product and accompanying documentation.

Conversely, the 2023 curriculum positions learners as active investigators, collaborators, designers, innovators, and critical thinkers. Students are expected to formulate questions, identify authentic technological problems, generate alternative design solutions, evaluate evidence, revise prototypes, communicate findings, and reflect upon the broader environmental, social, and ethical implications of technological innovation. This represents a substantial pedagogical shift from knowledge acquisition towards competence development and learner agency.

The role of the teacher also changes considerably (Demet Sever, and Bostancı, 2020). Whereas the earlier curriculum largely portrays the teacher as an organiser of technological projects, provider of technical guidance, the 2023 curriculum increasingly conceptualises the teacher as a facilitator of inquiry, collaborative learning, engineering design, and interdisciplinary problem-solving, acting as a mentor-advisor as well (Leontopoulos et al., 2025; Leontopoulos et al., 2024c; Chu, 2020). This transformation reflects constructivist and sociocultural approaches to learning, particularly those proposed by Piaget, Vygotsky, and Bruner, where learning emerges through guided exploration rather than direct instruction (Bruner, 1966) not only in secondary education but also in vocational education (Skenderidis et al., 2024), in classes with "charismatic" and with learning difficulties students (Leontopoulos et al., 2024b; Ioannidi and Samara, 2019) and in higher education studies (Vagelas and Leontopoulos 2023).

From the perspective of curriculum theory, the findings indicate that the reform extends well beyond modifications in curriculum content. Instead, the transition represents a broader paradigm shift from a content-oriented curriculum towards a competency-oriented curriculum. Such transformations have been widely documented internationally as educational systems increasingly respond to digital transformation, sustainable development, and the competencies required within knowledge societies.

Table 5: Comparative analysis of the educational philosophy of the two Curricula

Dimension	Curriculum 2014	Curriculum 2023	Interpretation
Educational philosophy	Technology literacy through technological knowledge	Competency-based technological literacy	Shift from content to competencies
Main educational goal	Understanding technological artefacts	Solving authentic technological problems	Inquiry orientation
Organisation	Technological sectors	Competencies and practices	Curriculum redesign
Nature of learning	Individual technological construction	Collaborative engineering design	Constructivist transformation
Student role	Constructor	Designer – Researcher – Innovator	Learner agency
Teacher role	Instructor	Facilitator	Sociocultural learning
Technology	Subject of study	Means for innovation	Engineering perspective
Knowledge	Technological concepts	Integrated STEM competencies	Interdisciplinarity
Sustainability	Limited references	Core curriculum principle	UNESCO alignment
Innovation	Secondary objective	Central educational objective	OECD Learning Compass

The qualitative content analysis therefore demonstrates that the educational philosophy of the Greek Curriculum for the "Technology" course in 8th grade has undergone a comprehensive transformation between 2014 and 2023. Rather than revising isolated curriculum objectives, the reform introduces a fundamentally different conception of the "Technology" course that aligns closely with international developments in Integrated STEM education, Engineering Design, sustainability education, and competency-based curriculum design. This finding provides the overarching interpretative framework for understanding the subsequent changes identified in learning objectives, pedagogical approaches, assessment practices, and technological competencies, which are analysed in the following sections.

4.2 Evolution of Curriculum aims and learning outcomes

The qualitative content analysis revealed substantial differences between the 2014 and 2023 curricula regarding the formulation of curriculum aims and expected learning outcomes. Although both curriculum documents seek to cultivate students' technological literacy, they differ considerably in their conceptualization of what students should know, understand, and be able to accomplish by the end of Grade 8. These differences extend beyond changes in wording and reflect a broader transition from a knowledge-oriented curriculum towards a competency-based educational framework.

The 2014 Curriculum for the "Technology" course in 8th grade organizes learning objectives around the acquisition of technological knowledge and the development of practical construction skills. Students are expected to mostly become familiar with technological professions while they are also expected to understand the nature of technology, recognize its historical evolution, investigating technological sectors, developing practical abilities through model construction, and independently collecting information from a variety of sources. Emphasis is also placed on cultivating students' ability to select appropriate tools and materials, solve practical technological problems, and communicate their work through written reports and oral presentations.

A defining characteristic of the 2014 curriculum is the predominance of objectives describing observable products of learning. Most intended outcomes relate to the successful completion of an individual technological project, the construction of a physical model of a modern factory, and the production of a written technological report. While these objectives undoubtedly foster important practical abilities, they primarily assess students' capacity to reproduce technological knowledge and demonstrate procedural competence within relatively structured learning environments.

In contrast, the 2023 Curriculum adopts an outcome framework explicitly centred on competencies. Rather than emphasizing what students should remember or construct, the curriculum describes what learners should be capable of accomplishing through the integration of knowledge, skills, attitudes, and values. Learning outcomes are formulated around inquiry, creativity, critical thinking, engineering design, computational reasoning, collaboration, communication, responsible innovation, sustainability, and active participation in solving authentic technological problems. This change reflects one of the most important findings of the present analysis: the evolution from content-based objectives to competency-based learning outcomes. The new curriculum no longer treats technological knowledge as an end in itself but as a resource employed during the design, evaluation, and optimisation of technological solutions. Knowledge therefore becomes functional rather than declarative.

Another important distinction concerns the increasing complexity of expected cognitive processes. The learning objectives contained in the 2014 curriculum predominantly correspond to lower and intermediate cognitive levels, including identifying, describing, investigating, constructing, and presenting. Although problem solving is acknowledged, it is generally situated within the context of completing an individual technological artefact.

The 2023 curriculum, by comparison, requires learners to engage in substantially more sophisticated cognitive operations. Students are expected to analyse complex situations, formulate design criteria, generate alternative solutions, evaluate evidence, justify design decisions, optimise prototypes, reflect upon technological consequences, and transfer knowledge across disciplinary boundaries. Such learning outcomes correspond to higher-order cognitive processes described in revised taxonomies of educational objectives and are consistent with international competence-based curriculum frameworks.

The qualitative analysis also revealed a fundamental shift regarding the nature of technological knowledge itself. In the earlier curriculum, knowledge is primarily organised around construction and industrial production. These domains constitute the principal structure through which students encounter technology.

In the revised curriculum, however, knowledge is organised around practices, concepts, and cross-cutting competencies rather than technological sectors alone agreed with Mahmud, (2018) study. Students learn by engaging in engineering design, scientific inquiry, digital modelling, computational thinking, systems analysis, and collaborative problem solving. This organisational principle reflects international developments in technology education, particularly those associated with the NGSS and Integrated STEM education. An equally significant finding concerns the treatment of 21st century competencies. The 2014 curriculum refers to several important skills, including information gathering, independent work, communication, practical construction, and problem solving. Nevertheless, these competencies function primarily as supporting mechanisms for the completion of technological projects.

By contrast, the 2023 curriculum positions transversal competencies as explicit educational outcomes. Creativity, innovation, communication, collaboration, critical thinking, digital competence, adaptability, systems thinking, ethical reasoning, and learner agency become central curriculum objectives rather than secondary educational benefits. This reflects the influence of international policy frameworks, particularly the OECD Learning Compass 2030, which conceptualises education as preparing learners to create new value, reconcile tensions, and take responsible action within increasingly complex societies.

Furthermore, the revised curriculum expands the affective dimension of learning outcomes. Whereas the 2014 curriculum primarily focuses on the production methods and how a modern factory works, the 2023 curriculum incorporates broader educational values associated with environmental responsibility, sustainability, inclusion, ethical innovation, democratic participation, and social responsibility. These additions demonstrate a clear alignment with UNESCO's Education for Sustainable Development framework, which argues that future-oriented curricula should foster values and dispositions alongside disciplinary knowledge.

The analysis also identified an important evolution in learner autonomy. Although the earlier curriculum encourages students to conduct individual investigations and prepare independent projects presenting job descriptions found in a modern factory, these activities are largely teacher-directed and follow predefined technological procedures. Conversely, the 2023 curriculum expects learners to assume significantly greater responsibility for defining problems, planning investigations, selecting appropriate methodologies, evaluating evidence, and reflecting upon the effectiveness of their own learning strategies. Such learner agency represents a defining characteristic of competence-based education.

Another notable transformation concerns are interdisciplinarity. The 2014 curriculum occasionally acknowledges relationships between technology and other fields of knowledge, but these connections remain relatively limited and primarily illustrative. In contrast, the 2023 curriculum systematically integrates science, technology, engineering, mathematics, digital technologies, environmental education, and creativity within coherent learning experiences. Interdisciplinary integration therefore becomes an explicit curriculum objective rather than an optional pedagogical strategy.

From the perspective of learning sciences, these findings indicate that the curriculum reform embodies a transition from predominantly procedural learning outcomes towards adaptive expertise. Students are no longer expected simply to perform technological tasks correctly but to transfer knowledge across contexts, address novel situations, evaluate competing alternatives, and continuously improve technological solutions. This educational orientation closely aligns with contemporary theories of adaptive expertise and lifelong learning.

The evolution of curriculum aims also has important implications for assessment (Hattie and Timperley, 2007). When learning outcomes emphasize competencies such as collaboration, creativity, engineering reasoning, computational thinking, and reflective practice, assessment necessarily shifts away from evaluating only final products towards documenting learning processes, design decisions, iterative improvement, and collaborative performance. Consequently, the reform of curriculum aims establishes the foundation for the transformation of assessment philosophy. The comparative analysis (Table 6) demonstrates that the reform of curriculum aims is not merely a revision of learning objectives but a comprehensive redefinition of the intended outcomes of technology education. The 2023 curriculum reconceptualises technological learning as the development of integrated competencies that combine disciplinary knowledge, engineering practices, computational thinking, ethical responsibility, sustainability, and learner agency. This transformation provides the pedagogical foundation for the subsequent changes identified in instructional strategies, Engineering Design, STEAM integration, and assessment practices, which are examined in the following sections (Hattie and Timperley, 2007).

Table 6: Comparative analysis of curriculum aims and learning outcomes

Analytical Dimension	Curriculum 2014	Curriculum 2023	Interpretation
Primary orientation	Knowledge and practical skills	Competencies and transferable capabilities	Competency-based curriculum
Learning objectives	Understand, investigate, construct	Design, analyse, evaluate, innovate	Higher-order cognitive demand
Organisation of knowledge	Technological sectors	Practices, concepts and competencies	Reorganisation of curriculum architecture

Nature of technological literacy	Understanding technological artefacts	Solving authentic technological challenges	Functional technological literacy
Student autonomy	Guided independent work	Learner agency and self-regulation	Greater responsibility for learning
Problem solving	Practical construction problems	Authentic, interdisciplinary societal problems	Expansion of problem contexts
Interdisciplinarity	Limited	Systematic integration of STEM/STEAM	Integrated learning
21st century competencies	Implicit	Explicit curriculum outcomes	Alignment with OECD Learning Compass
Sustainability and ethics	Limited references	Core learning outcomes	Alignment with UNESCO ESD
Digital competence	Supporting tool	Fundamental educational competence	Alignment with DigComp

4.3 Pedagogical transformation: From project construction to inquiry-driven learning

One of the most significant themes emerging from the qualitative content analysis concerns the transformation of the pedagogical model underpinning the Curriculum of the "Technology" course. Although both curriculum documents advocate experiential learning, they differ substantially regarding the role of the learner, the nature of classroom activities, the instructional strategies employed, and the conceptualization of teaching itself (Table 7).

In more detail, the 2014 curriculum is primarily organised around the implementation of individual technological projects. Students investigate a technological sector, collect information from printed and digital sources, prepare a written report, describe a job in a modern factory, construct a model of a modern factory and present their work. The pedagogical emphasis is placed on experiential engagement, but learning activities remain relatively structured and follow a predetermined sequence established by the teacher. Consequently, project work functions mainly as a means for applying previously acquired technological knowledge. The coding process identified a predominance of categories associated with project implementation, technological investigation, model construction, and teacher-guided learning. Although these approaches align with experiential learning principles, opportunities for iterative inquiry, collaborative design, and open-ended problem solving remain comparatively limited.

The 2023 curriculum, by contrast, introduces a markedly different pedagogical orientation. Learning is no longer centred on the completion of a technological artefact but on participation in an iterative process of inquiry, design, testing, evaluation, and redesign. Students are expected to investigate authentic problems, formulate research questions, establish design criteria, generate multiple solutions, construct prototypes, collect evidence, evaluate alternative approaches, and revise their designs based on empirical findings. This pedagogical transformation closely aligns with inquiry-based learning, which positions learners as active investigators rather than passive recipients of knowledge. Within inquiry-oriented classrooms, knowledge emerges through exploration, experimentation, reflection, and collaborative reasoning. The shift identified in the Greek curriculum therefore reflects broader international trends that emphasize authentic learning experiences over procedural reproduction.

The analysis also demonstrates a significant evolution in the conception of the teacher's role. Collaborative networks within schools also have a greater effect on teachers' innovativeness, and innovative school climate can be predicted by the network within school and among schools, as well as by the support that school teachers receive (Xafakos et al., 2020; Bahtilla and Hui, 2021).

In the 2014 curriculum, teachers primarily organise learning activities, supervise technological construction, provide technical guidance, and evaluate the completed project. In the revised curriculum, however, teachers increasingly function as facilitators, mentors, and learning designers who scaffold inquiry, support collaborative learning, encourage reflection, and guide students through the Engineering Design process.

This finding is consistent with Vygotsky's sociocultural theory, according to which teachers create learning environments that enable students to operate within their zone of proximal development through carefully structured support and collaborative interaction. Similarly, Bruner's concept of scaffolding is clearly reflected in the revised curriculum, where guidance progressively decreases as learners assume greater responsibility for planning and regulating their own learning.

Another notable finding concerns the increasing importance of reflection. Whereas the earlier curriculum primarily evaluates the final technological product, the revised curriculum encourages students to document decision-making processes, justify design choices, evaluate prototype performance, and critically reflect upon both successes and limitations. Reflection therefore becomes an explicit learning outcome rather than an implicit consequence of project work.

From the perspective of Project-Based Learning theory, this represents a transition from project-oriented instruction to project-based inquiry. As argued by Blumenfeld et al., (1991) and Thomas, (2000), authentic PBL requires sustained investigation of meaningful problems rather than the simple production of artefacts. The 2023 curriculum demonstrates considerably stronger alignment with this theoretical model.

Table 7: Pedagogical transformation identified through the qualitative content analysis

Pedagogical Dimension	Curriculum 2014	Curriculum 2023	Interpretation
Learning model	Individual project	Inquiry-driven learning	Student-centred pedagogy
Main activity	Model construction	Engineering investigation	Authentic problem solving
Teacher role	Instructor	Facilitator	Constructivist teaching
Student role	Constructor	Researcher and designer	Learner agency
Inquiry	Limited	Extensive	Inquiry-based learning
Collaboration	Occasional	Systematic	Sociocultural learning

Reflection	Product evaluation	Continuous reflection	Metacognitive development
Learning process	Linear	Iterative	Engineering Design cycle

4.4 Engineering design as the organising principle of the new Curriculum

As it is presented in Table 8, the qualitative content analysis identifies Engineering Design as the most significant conceptual innovation introduced in the 2023 Curriculum for the "Technology" course. While the 2014 curriculum includes elements of technological design through model construction and project implementation, engineering design is not explicitly conceptualised as the organising framework for learning. Instead, students primarily apply existing technological knowledge to construct artefacts that illustrate specific technological concepts.

In contrast, the 2023 curriculum positions Engineering Design at the centre of the educational process. Learning is structured around identifying authentic problems, analysing user needs, defining design criteria, generating alternative solutions, developing and testing prototypes, evaluating performance, and iteratively improving designs. This sequence mirrors the engineering design cycle promoted by the Next Generation Science Standards (NGSS) and reflects a shift from technology as a subject of study to technology as a process of innovation.

The coding framework revealed a substantial increase in references to concepts such as problem definition, design thinking, prototype development, optimisation, evaluation, and iterative improvement within the 2023 curriculum. These concepts were either absent or only marginally represented in the 2014 curriculum. Their emergence indicates a reorientation of technological learning towards engineering practices rather than solely technological knowledge.

Engineering Design also transforms the epistemological foundations of the curriculum. Knowledge is no longer viewed as a body of information to be acquired before application but as a resource that is continuously generated, tested, revised, and refined during the design process. Students therefore engage simultaneously in scientific reasoning, technological creativity, and engineering decision-making, illustrating the integrated nature of contemporary STEM education (English, 2016; Honey et al., 2014).

This pedagogical orientation closely aligns with Kelley and Knowles, (2016) conception of Integrated STEM Education, where disciplinary boundaries become permeable and authentic design challenges provide the context for meaningful learning. Moreover, the engineering design cycle supports the development of adaptive expertise, enabling learners to transfer knowledge across contexts and address novel technological challenges.

Table 8: Engineering design across the two Curricula

Engineering Design Component	**Curriculum 2014**	**Curriculum 2023**	**Interpretation**
Problem identification	Limited	Explicit	Authentic design challenges
Design criteria	Implicit	Explicit	Engineering methodology
Alternative solutions	Rare	Systematic	Divergent thinking
Prototype development	Physical models	Iterative prototypes	Design-based learning
Testing and optimisation	Minimal	Core activity	Continuous improvement
Reflection	Final evaluation	Ongoing design reflection	Engineering habits of mind
Curriculum role	Supporting activity	Organising principle	Paradigm shift

The next section addresses one of the most significant innovations of the new curriculum: the integration of STEAM, computational thinking, and digital literacy.

4.5 STEAM integration, computational thinking and digital competence

One of the most prominent themes emerging from the qualitative content analysis concerns the transition from a predominantly technology-oriented curriculum towards an integrated STEAM curriculum that combines science, technology, engineering, arts, and mathematics within authentic technological problem-solving contexts. This transition constitutes one of the most significant conceptual innovations identified in the 2023 Curriculum for the "Technology" course in 8th grade and illustrates the alignment of the Greek educational reform with international developments in STEM education.

The analysis presented in Table 9 indicates that the 2014 curriculum approaches the "Technology" course in 8th grade primarily as an autonomous school subject. Although references to scientific principles, mathematics, environmental issues, and industrial applications are evident, these disciplines remain largely complementary rather than structurally integrated. Students investigate technological artefacts belonging to different production sectors, construct physical models, and examine the relationship between technology and society; however, interdisciplinary knowledge is employed mainly to support technological understanding rather than to solve complex real-world problems.

The coding process identified only sporadic references to interdisciplinary learning, while no explicit references were found concerning Integrated STEM, STEAM education, computational thinking, algorithmic reasoning, digital modelling, or engineering practices. Consequently, interdisciplinarity appears to function primarily as an instructional recommendation rather than as a curriculum design principle.

A substantially different picture emerges from the analysis of the 2023 curriculum. The revised curriculum explicitly conceptualises the "Technology" course and technology education as an interdisciplinary learning environment in which scientific knowledge, engineering practices, mathematical reasoning, creativity, and digital technologies interact continuously throughout the learning process (de Vries, 2016; 2018). Authentic technological problems become the organising context through which students integrate concepts originating from multiple disciplines while simultaneously developing transferable competencies.

This finding demonstrates a clear shift from multidisciplinarity towards interdisciplinarity. Rather than studying technology alongside other disciplines, learners are expected to combine scientific investigation, engineering design, computational reasoning, mathematical modelling, creativity, and communication within coherent design projects. Such integration corresponds closely to the definition of Integrated STEM proposed by Kelley and Knowles (2016), according to which meaningful STEM education requires the purposeful interaction of multiple disciplines around authentic engineering challenges.

An important finding concerns the explicit incorporation of Engineering Design as the pedagogical mechanism through which interdisciplinary learning is achieved. Engineering challenges require students to draw simultaneously upon scientific concepts, technological knowledge, mathematical calculations, digital tools, and creative thinking. Consequently, disciplinary boundaries become increasingly permeable, while knowledge is reorganised around authentic design problems rather than traditional subject divisions.

The qualitative content analysis further demonstrates that the revised curriculum introduces Computational Thinking as an explicit educational objective. Although programming is not presented as an end in itself, students are encouraged to employ decomposition, abstraction, pattern recognition, algorithmic reasoning, modelling, and iterative optimisation during technological design activities. These competencies are recognised internationally as foundational skills for participation in digitally mediated societies.

The emergence of computational thinking represents a substantial conceptual departure from the earlier curriculum. No explicit references to computational reasoning, algorithmic thinking, or digital modelling were identified within the 2014 curriculum. Instead, digital technologies primarily function as information sources supporting technological investigation.

The 2023 curriculum, however, conceptualises digital technologies as cognitive tools supporting inquiry, simulation, collaboration, modelling, communication, and innovation. This transformation reflects the evolution of digital technologies from instructional resources towards integral components of technological thinking itself.

From the perspective of educational theory, this shift is consistent with Papert's constructionism, where digital environments enable learners to externalise their thinking through modelling, simulation, programming, and iterative design. Likewise, Wing's, (2006) conception of computational thinking as a universal problem-solving competence provides a useful framework for interpreting the revised curriculum's emphasis on abstraction, decomposition, and algorithmic reasoning.

Another important finding concerns the integration of digital competence. Whereas the earlier curriculum focuses primarily on acquiring information through traditional and digital sources, the revised curriculum expands digital competence to include collaboration, digital content creation, responsible participation, critical evaluation of information, communication, and technological innovation. This broader interpretation closely aligns with the European Digital Competence Framework (DigComp) and DigCompEdu, both of which conceptualise digital literacy as a multidimensional competence extending beyond technical skills.

Furthermore, the analysis identified a stronger emphasis on creativity within the revised curriculum. The incorporation of artistic design, visual communication, aesthetic judgement, and user-centred design demonstrates the influence of the STEAM movement, which recognises creativity as an essential component of technological innovation. Rather than separating artistic expression from technological design, the curriculum encourages learners to integrate functionality, aesthetics, sustainability, and usability throughout the engineering process (Wiek et al., 2011).

Collectively, these findings indicate that the revised curriculum adopts a much broader conception of technological literacy than its predecessor. Technology education evolves from understanding technological systems towards designing innovative solutions through the integration of scientific knowledge, engineering practices, digital competence, creativity, and computational reasoning. Such an educational philosophy reflects the competency frameworks proposed by the OECD Learning Compass 2030 and the European Commission, which emphasise creativity, digital fluency, interdisciplinary collaboration, and lifelong learning as fundamental characteristics of future-ready education.

Table 9: Integration of STEAM, computational thinking and digital competence

Analytical Dimension	Curriculum 2014	Curriculum 2023	Interpretation
STEM integration	Limited references	Explicit and systematic	Transition to Integrated STEM
STEAM	Absent	Explicit incorporation	Creativity integrated into technological learning
Engineering	Construction activities	Engineering Design methodology	Engineering as organising principle
Computational Thinking	Absent	Explicit learning outcome	Development of algorithmic reasoning
Digital Technologies	Information retrieval	Design, modelling and collaboration tools	Digital transformation of learning
Digital Competence	Supporting skill	Core competence	Alignment with DigComp
Creativity	Product design	Innovation process	STEAM philosophy
Interdisciplinarity	Complementary	Structural curriculum principle	Integrated curriculum

4.6 Sustainability, Responsible Research and Innovation (RRI), and global citizenship

The qualitative content analysis revealed that the incorporation of sustainability constitutes one of the most profound conceptual differences between the two curriculum frameworks (Table 10) (Sterling, 2001; Wiek et al., 2011). While both curricula acknowledge the relationship between technology and society, the scope, depth, and educational purpose of these references differ substantially.

The 2014 curriculum recognizes that technological development influences industrial production, environmental conditions, energy use, transportation systems, agriculture, and everyday life. Students are encouraged to investigate the historical evolution of technological sectors and examine their contribution to economic and social development. Environmental awareness is therefore present; however, it functions primarily as contextual knowledge accompanying technological investigation rather than as an organising educational principle.

In contrast, the 2023 curriculum embeds sustainability within the core philosophy of technology education. Technological innovation is explicitly linked to environmental responsibility, social inclusion, ethical decision-making, circular economy principles, efficient resource management, and the design of solutions addressing contemporary global challenges. Students are expected not only to understand technological systems but also to evaluate their environmental, economic, and social consequences before proposing alternative solutions. This finding reflects a transition from technology education about society towards technology education for sustainable societal transformation.

An equally significant innovation concerns the integration of Responsible Research and Innovation (RRI). The coding analysis identified explicit references to ethical reflection, stakeholder participation, anticipation of technological consequences, and responsible innovation within the revised curriculum. These concepts were absent from the earlier curriculum, where technological development was primarily presented as a process of industrial and scientific advancement.

The incorporation of RRI demonstrates alignment with European research and innovation policies, which advocate that technological development should anticipate societal needs, involve citizens in decision-making, and promote ethical, inclusive, and sustainable innovation.

The revised curriculum also reflects the philosophy of the United Nations Sustainable Development Goals (SDGs), particularly those related to quality education, responsible consumption and production, climate action, sustainable communities, industry and innovation, and partnerships. Although the SDGs are not always cited explicitly, their underlying principles permeate the curriculum through authentic design challenges centred on environmental sustainability, energy efficiency, waste reduction, and socially responsible technological solutions.

Furthermore, the curriculum expands the concept of citizenship itself. Students are no longer viewed merely as future users of technology but as active citizens capable of contributing to sustainable technological futures through informed decision-making, collaborative action, and responsible innovation. This perspective corresponds closely with UNESCO's Education for Sustainable Development (ESD) framework, which emphasises systems thinking, anticipatory competence, normative competence, strategic competence, collaboration, and self-awareness as essential sustainability competencies.

Another important finding concerns the emergence of systems thinking. The revised curriculum encourages learners to understand technology as part of interconnected environmental, economic, social, and technological systems rather than as isolated artefacts. Such systems-oriented perspectives are largely absent from the earlier curriculum and represent one of the defining characteristics of 21st century technology education (Jones, 1997).

Table 10: Sustainability and Responsible Innovation

Dimension	**Curriculum 2014**	**Curriculum 2023**	**Interpretation**
Environmental education	Contextual	Central curriculum principle	ESD integration
Sustainability	Limited references	Systematically embedded	UNESCO alignment
Responsible Research and Innovation	Absent	Explicit	European RRI framework
SDGs	Not evident	Strong conceptual alignment	Global citizenship education
Ethics	Limited	Integrated into design process	Responsible innovation
Systems thinking	Minimal	Explicit	Holistic technological literacy
Citizenship	Technology user	Responsible innovator	Active citizenship

4.7 Evolution of assessment philosophy

The qualitative content analysis revealed that one of the most substantial changes introduced by the 2023 Curriculum of the "Technology" course for 8th Grade (2nd class of Gymnasium) concerns the conceptualisation of assessment (Table 11). While both curriculum documents recognise assessment as an integral component of teaching and learning, they differ fundamentally regarding its educational purpose, assessment criteria, and the forms of evidence considered indicative of successful learning.

The 2014 curriculum primarily conceptualises assessment as the evaluation of students' ability to complete an individual technological project. Assessment focuses on the quality of the constructed model, the organisation and accuracy of the accompanying written report, the presentation of the technological investigation, and the student's ability to demonstrate understanding of technological concepts. Although the curriculum acknowledges the importance of the learning process, assessment remains predominantly product-oriented, with the final technological artefact functioning as the principal indicator of achievement.

The coding analysis identified frequent references to categories associated with construction quality, technical accuracy, written documentation, and individual performance. Assessment therefore largely measures the successful application of technological knowledge within predefined project specifications. Feedback primarily serves to verify the correctness and completeness of students' work rather than to support continuous learning (Hattie and Timperley, 2007).

In contrast, the 2023 curriculum adopts a markedly broader conception of assessment. Evaluation is no longer restricted to the quality of the final product but encompasses the entire learning process, including problem formulation, inquiry, collaboration, design thinking, prototype development, iterative improvement, reflection, communication, and responsible decision-making.

This shift reflects the transition from assessment of learning toward assessment for learning and assessment as learning. Students are expected to receive continuous formative feedback throughout the engineering design cycle, enabling them to revise ideas, improve prototypes, justify decisions, and monitor their own progress. Assessment consequently becomes an integral component of learning rather than a concluding evaluative activity.

A particularly important finding concerns the increased emphasis on formative assessment. Whereas the earlier curriculum primarily documents completed performance, the revised curriculum encourages continuous observation, peer assessment, self-assessment, reflective journals, design portfolios, collaborative discussions, and iterative evaluation. All these practices support the development of metacognitive awareness and learner autonomy, two competencies consistently highlighted within contemporary educational research. In particular, according to Rahmat et al. (2019) class discussions can lead to learning of new knowledge acquisition among team members, since the process of learning is a result of social interaction-both positive and negative.

The analysis further demonstrates that the revised curriculum recognises collaboration itself as an assessable educational outcome. Group interaction, communication, negotiation of ideas, collective problem solving, and participation in engineering design activities become legitimate dimensions of student achievement. This contrasts with the predominantly individual assessment model evident in the 2014 curriculum.

Another significant transformation concerns the evaluation of creativity and innovation. The earlier curriculum mainly assesses the accuracy with which technological models represent existing technologies. Conversely, the revised curriculum encourages originality, alternative solutions, experimentation, and innovation, thereby recognising divergent thinking as a desirable educational outcome.

From an international perspective, these findings demonstrate strong alignment with the OECD Learning Compass 2030 and UNESCO's competency-based educational frameworks, both of which advocate authentic assessment capable of capturing complex competencies rather than isolated factual knowledge. Similarly, the revised assessment philosophy corresponds closely with Engineering Design education, where iterative refinement, reflection, and evidence-based optimisation constitute essential elements of successful engineering practice.

Table 11: Comparative analysis of assessment philosophy

Assessment Dimension	Curriculum 2014	Curriculum 2023	Interpretation
Main focus	Final product	Learning process	Shift to formative assessment
Assessment orientation	Assessment of learning	Assessment for and as learning	Competency-based evaluation
Evidence of learning	Technological model and report	Inquiry, collaboration, reflection, design	Holistic assessment
Student role	Demonstrates achievement	Monitors and regulates learning	Self-regulated learning
Feedback	Final evaluation	Continuous formative feedback	Learning improvement
Collaboration	Limited	Explicitly assessed	Sociocultural assessment
Creativity	Secondary	Core assessment criterion	Innovation-oriented evaluation
Reflection	Limited	Systematic	Metacognitive development

The qualitative findings therefore indicate that the curriculum reform redefines not only what students learn but also how learning is recognised and valued. Assessment evolves from verifying technological performance to documenting the development of complex competencies, thereby reinforcing the broader shift toward learner-centred and competency-based technology education.

However, in a study completed by Chiou et al., (2025) teachers reported a willingness to participate in training that would help them effectively use assessment tools, thus promoting assessment for learning in their classrooms.

In international literature the presentation of individual results is followed by a cross-case synthesis that captures the overall shift in the educational paradigm. For this reason, the final two sections of the results will not merely provide a description; instead, they will present the Paradigm Shift Matrix, which constitutes the article's key scientific finding.

4.8 Overall paradigm shift: Synthesis of the qualitative content analysis

The preceding analyses collectively demonstrate that the transition from the 2014 to the 2023 Curriculum of the "Technology" course in 8th grade cannot be interpreted as a simple curriculum revision involving modifications of learning objectives or teaching activities. Instead, the qualitative content analysis indicates the emergence of a new educational paradigm that fundamentally redefines the nature, purpose, and pedagogical foundations of technology education within Greek lower secondary schools (Gymnasium) (Table 12).

Across all analytical categories, the findings consistently reveal a movement from a curriculum organised around technological knowledge and product construction toward one centred on competencies, engineering practices, interdisciplinary problem solving, sustainability, and responsible innovation. This transformation extends to every dimension examined in the study, including educational philosophy, curriculum aims, pedagogy, Engineering Design, STEAM integration, computational thinking, sustainability, and assessment.

The coding framework demonstrates that the 2014 curriculum predominantly reflects the educational priorities of earlier technology education reforms, where technological literacy is closely associated with understanding industrial production, technological sectors, practical construction, and individual project work. Although these characteristics remain educationally valuable, they largely represent a content-oriented conception of curriculum design.

The 2023 curriculum, in contrast, reflects the educational priorities of the 21st century. Technological literacy is redefined as the capacity to understand, design, evaluate, and improve technological solutions through interdisciplinary collaboration, engineering reasoning, computational thinking, creativity, ethical reflection, and sustainable innovation. Learning therefore becomes a dynamic process of knowledge construction rather than the acquisition of predefined content.

The integration of Engineering Design constitutes the structural mechanism through which this transformation is realised. Rather than functioning as an additional instructional strategy, engineering design reorganizes the curriculum by linking scientific inquiry, mathematical reasoning, technological creativity, digital competence, and authentic societal challenges into coherent learning experiences. This finding strongly supports the argument that Engineering Design functions as the conceptual bridge between technology education and Integrated STEM education.

Furthermore, the analysis demonstrates that sustainability is no longer treated as an auxiliary topic but becomes an organising principle permeating curriculum aims, pedagogical approaches, design activities, and assessment. This finding illustrates the increasing influence of UNESCO's Education for Sustainable Development framework and the United Nations Sustainable Development Goals on national curriculum development.

Similarly, the emergence of computational thinking, digital competence, Responsible Research and Innovation (RRI), and learner agency indicates that the revised curriculum responds directly to international educational priorities concerning digital transformation and innovation. These competencies are largely absent from the earlier curriculum, further illustrating the extent of the educational reform.

The synthesis of findings therefore suggests that curriculum evolution has occurred simultaneously across three interconnected levels: a) Epistemological transformation, involving changes in the conceptualisation of technological knowledge; b) pedagogical transformation, involving changes in instructional practices, learner participation, and assessment; and c) societal transformation, involving the redefinition of technology education as a vehicle for sustainable development, responsible innovation, and active citizenship. These three dimensions interact continuously, producing a curriculum that differs qualitatively-not merely quantitatively-from its predecessor.

Table 12: Paradigm shift matrix emerging from the qualitative content analysis

Analytical Category	Curriculum 2014	Curriculum 2023	Nature of Transformation
Educational philosophy	Technology-centred	Competency-centred	Curriculum paradigm shift
Curriculum structure	Technological sectors	Practices and competencies	Curriculum redesign
Learning orientation	Knowledge acquisition	Knowledge construction	Constructivist transformation
Pedagogy	Individual projects	Inquiry and Engineering Design	Student-centred learning
Student role	Constructor	Designer, innovator, researcher	Learner agency
Teacher role	Instructor	Facilitator and mentor	Sociocultural pedagogy
Engineering	Supporting element	Organising principle	NGSS alignment
STEM	Limited	Fully integrated STEAM	Interdisciplinary curriculum
Computational Thinking	Absent	Explicit	Digital transformation
Digital Competence	Supporting tool	Core educational outcome	DigComp alignment
Sustainability	Contextual topic	Cross-cutting principle	UNESCO ESD alignment
Responsible Innovation	Absent	Explicit	RRI integration
Citizenship	Technology user	Responsible innovator	Global citizenship
Assessment	Product-oriented	Process-oriented	Formative assessment

The Paradigm Shift Matrix synthesises the central finding of the present investigation: the Greek Curriculum for the "Technology" course in 8th Grade (2nd class of Gymnasium) has evolved from a curriculum primarily concerned with technological knowledge and artefact construction into a curriculum oriented towards competence development, engineering design, sustainability, digital literacy, and responsible innovation. Figure 1, also describes the evolution of the "Technology" course curriculum for Grade 8 (2nd year of Gymnasium) in Greece from content transmission (2014) to competency development (2023). This transformation mirrors broader international trends in technology and STEM education and illustrates the increasing convergence of national curriculum reform with global educational agendas.

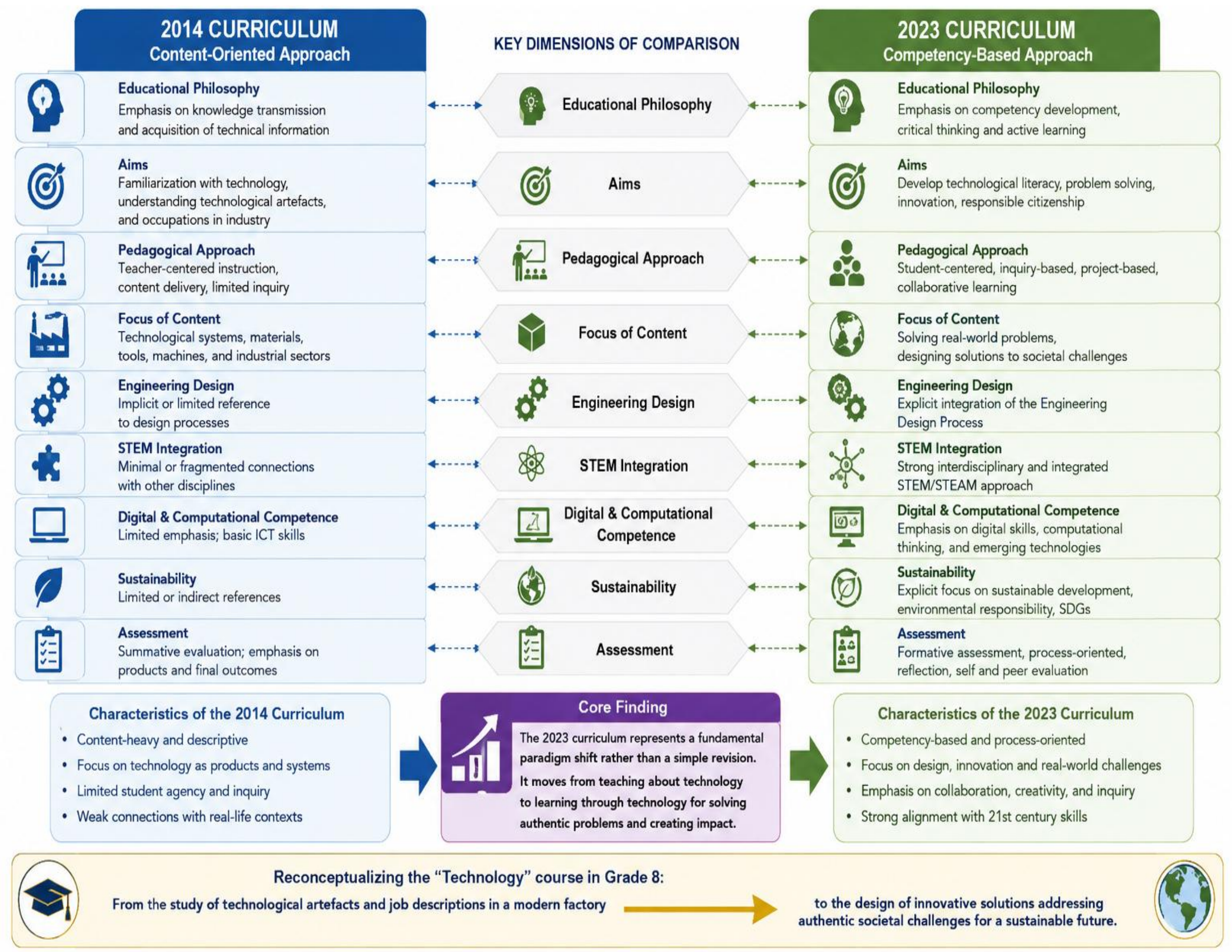

Figure 1: Evolution of the "Technology" course curriculum for Grade 8 (2nd year of Gymnasium) in Greece: From content transmission (2014) to competency development (2023). (Figure 1 has been created using Gemini AI tool).

5. Discussion

5.1 Curriculum evolution through the lens of constructivism

The findings of the present study indicate that the evolution of the Greek Curriculum for the "Technology" course of 8th grade between 2014 and 2023 represents considerably more than a revision of curriculum content. Rather, the qualitative content analysis reveals a substantial shift in the underlying epistemological assumptions concerning how technological knowledge is acquired, constructed, and applied within lower secondary education. This transformation can be interpreted convincingly through the theoretical perspective of constructivism.

According to Piaget, (1972), learning is an active process through which learners construct cognitive structures by interacting continuously with their physical and social environment. Knowledge cannot simply be transmitted from teacher to student; instead, learners actively re-organise existing cognitive schemas through processes of assimilation and accommodation. Technology education provides particularly favourable conditions for such cognitive development because technological design requires students to formulate hypotheses, manipulate materials, evaluate evidence, and modify their ideas through repeated experimentation transforming a "boring" lesson to a more interesting one, acting as a strategy for prevention of school dropout and several modern issues in a school environment (Skenderidou et al., 2025; Leontopoulos et al., 2024a). The analysis demonstrates that both curriculum documents incorporate constructivist elements; however, they operationalise constructivism in substantially different ways.

The 2014 curriculum reflects what may be described as first-generation constructivism. Students actively participate in technological investigations, construct physical models, collect information, describe jobs of a modern factory and prepare technological reports. These learning activities undoubtedly promote active participation and experiential learning, consistent with Piaget's conception of knowledge construction. Nevertheless, the learning trajectory remains relatively structured. Students generally investigate predetermined technological sectors, construct predefined artefacts, and follow instructional procedures established by the teacher. Consequently, learner autonomy is constrained by relatively fixed curricular pathways.

The 2023 curriculum represents a more advanced interpretation of constructivist learning. Rather than emphasising the acquisition of technological knowledge through construction activities, the curriculum conceptualises learning as an iterative process of inquiry, engineering design, critical reflection, optimisation, and knowledge generation. Students are expected to formulate authentic technological problems, establish design criteria, evaluate competing alternatives, revise prototypes, and justify design decisions through evidence-based reasoning. Knowledge therefore becomes dynamic, adaptive, and continuously reconstructed throughout the design process.

This distinction is consistent with contemporary interpretations of constructivism that emphasise authentic inquiry rather than procedural activity alone. Jonassen, (1999) for example, argues that meaningful learning environments require learners not merely to manipulate physical objects but to solve ill-structured problems requiring interpretation, decision-making, reflection, and negotiation of meaning. The revised Greek curriculum for the "Technology" course in 8th Grade (2nd class of Gymnasium) demonstrates considerably stronger alignment with this conception of constructivist pedagogy.

An equally important finding concerns the increasing emphasis placed upon metacognition. Reflection appears only implicitly within the earlier curriculum but becomes an explicit educational objective in the revised framework. Students are encouraged to evaluate the effectiveness of their own learning strategies, reconsider design decisions, identify weaknesses within prototypes, and justify modifications based upon empirical evidence. These practices support the development of self-regulated learning, recognised by contemporary educational research as a defining characteristic of deep conceptual understanding.

From the perspective of Bruner's theory of discovery learning (Bruner, 1961) the curriculum reform similarly reflects an important educational progression. Bruner argued that learners develop robust conceptual understanding when they actively discover relationships among ideas rather than receive information through direct instruction. The 2023 curriculum increasingly positions technological knowledge as something to be discovered through systematic inquiry and engineering investigation rather than simply reproduced during project construction.

The findings therefore suggest that constructivism within Greek "Technology" course and technology education has evolved from a predominantly experiential approach towards a more sophisticated inquiry-based educational model integrating reflection, self-regulation, engineering reasoning, and authentic problem solving. This evolution mirrors broader international developments in technology education, where constructivist learning increasingly serves as the pedagogical foundation for competency-based curriculum design.

5.2 Sociocultural learning and the transformation of classroom practice

While constructivism explains the cognitive dimensions of curriculum reform, the findings can be interpreted equally effectively through Vygotsky's sociocultural theory of learning. Unlike Piaget, who emphasised individual cognitive development, Vygotsky, (1978) argued that higher-order thinking develops through social interaction, collaborative activity, and participation in culturally meaningful practices.

The qualitative content analysis demonstrates a clear shift from predominantly individual technological work towards collaborative knowledge construction. Although the 2014 curriculum encourages discussion and presentation of technological projects, the learning process remains centred upon individual investigation and construction. Collaboration appears primarily as organisational support rather than as the principal mechanism through which learning occurs.

Conversely, the 2023 curriculum conceptualises collaboration as an essential educational competence. Students are expected to negotiate design ideas, work collectively on engineering challenges, exchange evidence, justify alternative solutions, and participate in collaborative reflection. Learning therefore becomes fundamentally social rather than exclusively individual.

This transformation closely corresponds to Vygotsky's concept of the Zone of Proximal Development (ZPD). Engineering Design activities require learners to solve problems that often exceed their initial individual capabilities. Through collaboration with peers and teacher guidance, students progressively internalise more sophisticated technological reasoning. Consequently, the curriculum positions teachers as facilitators who scaffold increasingly complex design activities while gradually transferring responsibility to learners.

The evolution identified by the present study also reflects Bruner's notion of instructional scaffolding, whereby temporary support enables learners to accomplish progressively more demanding tasks until independent performance becomes possible. The revised curriculum explicitly encourages continuous teacher guidance during inquiry, design, testing, and reflection while simultaneously promoting increasing learner autonomy.

Another important implication concerns the changing nature of classroom discourse. The revised curriculum places considerable emphasis upon communication, argumentation, collaborative decision-making, and evidence-based justification. Such practices correspond closely to Mercer's, (2000) concept of exploratory talk, in which dialogue functions as a cognitive tool for constructing shared understanding rather than merely exchanging information.

Furthermore, the curriculum increasingly recognises knowledge as socially negotiated rather than individually possessed. Engineering challenges require students to evaluate competing ideas, integrate multiple perspectives, negotiate design criteria, and collectively optimise technological solutions. Such learning environments exemplify communities of practice, where knowledge emerges through participation in authentic technological activities.

The findings therefore indicate that the curriculum reform extends beyond methodological changes to redefine the social organisation of learning itself. Technology classrooms evolve from environments centred upon individual project completion towards collaborative design communities characterised by inquiry, communication, reflection, and shared problem solving.

5.3 Constructionism and Papert: From model construction to knowledge construction

Among the theoretical perspectives examined in the present study, Papert's Constructionism provides perhaps the most powerful explanation for the evolution of the Greek Curriculum for the "Technology" course in 8th Grade (2nd class of Gymnasium). Papert, (1980) argued that meaningful learning occurs when learners construct public artefacts that embody their thinking. These findings are in agreement with the conclusions of the study completed by Arokoyu and Wonu, (2019). Importantly, the educational value of construction lies not in the completed artefact itself but in the cognitive processes required to design, revise, test, and improve it. Artefact construction therefore becomes both the medium and the outcome of learning.

The 2014 curriculum demonstrates strong constructionist characteristics through its emphasis on technological models and individual projects. Students actively design and construct physical artefacts, thereby externalising technological understanding. However, the completed model frequently functions as the endpoint of learning.

The revised curriculum significantly expands this constructionist philosophy. Construction becomes iterative rather than linear. Prototypes are expected to evolve continuously through cycles of testing, evaluation, redesign, and optimisation. The artefact is no longer regarded as a final product but as a temporary representation of developing understanding.

This transformation aligns closely with Papert's original vision of learning environments where students continuously refine ideas through design experimentation. It also reflects the educational philosophy underpinning the international Maker Movement, Fab Labs, and design-based learning environments that have become increasingly influential within technology education during the past decade.

Moreover, the incorporation of computational thinking and digital technologies further strengthens the constructionist orientation of the revised curriculum. Digital modelling, simulation, programming, and iterative engineering design enable students to externalise increasingly sophisticated forms of reasoning while simultaneously integrating scientific, mathematical, and technological knowledge.

Consequently, the curriculum reform represents not simply an expansion of construction activities but a reconceptualisation of construction itself. Physical artefacts become epistemic objects through which learners generate, evaluate, and continuously reconstruct technological knowledge. At this point, the article moves to an interpretive synthesis of the findings, drawing on key international theoretical and regulatory frameworks for technology education. The subsequent sections constitute the article's primary theoretical contribution, as they go beyond merely describing the changes to explain why they occurred and how they align with global developments.

5.4 Engineering design and the Next Generation Science Standards (NGSS)

One of the central findings of this study concerns the emergence of Engineering Design as the organising principle of the 2023 Curriculum for the "Technology" course of 8th grade. The qualitative content analysis demonstrates that engineering practices no longer constitute isolated learning activities but function as the structural framework through which technological knowledge, scientific reasoning, mathematical thinking, creativity, and digital competence are integrated.

This finding can be interpreted through the theoretical framework of the Next Generation Science Standards (NGSS Lead States, 2013), which identify Engineering Design as one of the three fundamental dimensions of contemporary science and technology education, alongside disciplinary core ideas and crosscutting concepts. Within the NGSS framework, engineering is not viewed as an applied extension of science but as a distinct epistemic practice requiring learners to define problems, develop and evaluate solutions, optimise designs, and communicate evidence-based decisions.

The comparative analysis reveals that the 2014 curriculum exhibits only partial correspondence with this perspective. Students construct technological models and engage in practical activities; however, the learning sequence is primarily directed towards understanding existing technological artefacts rather than solving open-ended engineering problems. Design decisions are generally predetermined by project specifications, while opportunities for iterative redesign remain limited.

In contrast, the 2023 curriculum closely mirrors the engineering design cycle proposed by the NGSS. Students are expected to identify authentic societal problems, establish design constraints, investigate alternative solutions, construct prototypes, evaluate performance against explicit criteria, and revise their designs through iterative optimisation. Consequently, learning is organised around engineering practices rather than technological products.

The significance of this transition extends beyond instructional methodology. Engineering Design fundamentally transforms the epistemology of technology education. Knowledge is generated through cycles of investigation, modelling, testing, reflection, and redesign rather than through the sequential transmission of predefined content. Such an approach develops adaptive expertise, enabling learners to transfer knowledge across contexts and address novel technological challenges.

Furthermore, the incorporation of Engineering Design promotes systems thinking by encouraging students to consider technological, environmental, economic, and social dimensions simultaneously. This systems perspective is increasingly recognised as essential for preparing future citizens capable of addressing complex global challenges such as climate change, sustainable energy, digital transformation, and resource management.

The present findings therefore indicate that the Greek curriculum reform aligns closely with international developments in Engineering Education, positioning engineering design not simply as a pedagogical technique but as the conceptual foundation of technological literacy.

5.5 Integrated STEM education through the framework of Kelley and Knowles

A second major finding concerns the systematic integration of STEM education within the revised curriculum. The qualitative analysis demonstrates that interdisciplinarity evolves from an occasional instructional recommendation into a fundamental curriculum principle. This transformation can be interpreted through the Integrated STEM framework proposed by Kelley and Knowles, (2016), who argue that meaningful STEM education requires purposeful integration of science, technology, engineering, and mathematics around authentic engineering problems rather than parallel teaching of individual disciplines.

The 2014 curriculum reflects what may be characterised as a multidisciplinary approach. Technology interacts with science, mathematics, environmental education, and social studies; however, these relationships remain largely supportive. Students acquire technological knowledge first and subsequently apply complementary concepts from other disciplines.

The revised curriculum represents a fundamentally different educational model. Learning activities are organised around authentic technological challenges that simultaneously require scientific inquiry, mathematical reasoning, engineering design, digital technologies, creativity, communication, and collaborative decision-making. Knowledge is therefore organised around problems rather than disciplines.

This finding strongly supports the argument that the curriculum has adopted an Integrated STEM philosophy. Engineering Design functions as the integrating mechanism connecting disciplinary knowledge into coherent learning experiences. Students no longer distinguish between scientific reasoning, technological creativity, mathematical modelling, and digital competence; instead, these competencies develop simultaneously through authentic design activities.

Another important implication concerns the role of creativity. The inclusion of artistic design, visual communication, aesthetics, user experience, and innovation reflects the international movement from STEM towards STEAM education. This broader perspective recognises creativity not as an optional addition to engineering but as an indispensable component of technological innovation.

The curriculum reform therefore reflects contemporary understandings of technological education as an interdisciplinary enterprise that prepares learners to address complex societal challenges through integrated knowledge and collaborative problem-solving.

5.6 Curriculum reform through the OECD learning compass 2030

The competency-based orientation identified throughout the qualitative content analysis demonstrates remarkable consistency with the principles articulated in the OECD Learning Compass 2030. The Learning Compass proposes that future curricula should move beyond the transmission of disciplinary knowledge towards the development of competencies enabling learners to create new value, reconcile tensions and dilemmas, and take responsible action. These transformative competencies require the integration of knowledge, skills, attitudes, and values within authentic learning environments.

The 2014 curriculum corresponds primarily to earlier curriculum models in which technological knowledge and practical skills constitute the principal educational outcomes. Although collaboration, communication, and problem-solving are encouraged, they function mainly as supporting competencies for technological projects. The revised curriculum exhibits a substantially broader conception of educational success. Students are expected to demonstrate creativity, critical thinking, ethical reasoning, adaptability, systems thinking, collaboration, digital competence, resilience, and responsible innovation. These competencies correspond directly to the transformative competencies identified by the OECD.

Moreover, the curriculum places increasing emphasis upon learner agency. Students are encouraged to formulate questions, make decisions, evaluate evidence, revise solutions, and assume responsibility for their own learning processes. This educational philosophy closely reflects the OECD's conception of students as active co-creators of knowledge rather than passive recipients of instruction. The findings therefore suggest that the Greek curriculum reform represents an explicit movement towards competence-based education consistent with international educational policy.

5.7 UNESCO education for sustainable development and responsible research and innovation

Perhaps the most distinctive feature of the revised curriculum concerns the integration of sustainability and responsible innovation across virtually all dimensions of technological learning. UNESCO's Education for Sustainable Development (ESD) framework argues that sustainability should not be taught as a separate subject but should permeate curriculum aims, pedagogical approaches, assessment practices, and school culture. Learners should develop systems thinking, anticipatory competence, normative competence, strategic competence, collaboration, and critical self-reflection.

The qualitative content analysis demonstrates strong alignment between these principles and the revised curriculum. Sustainability is embedded within technological problem solving, engineering design, resource management, environmental responsibility, and innovation rather than appearing as an isolated thematic unit.

Equally significant is the incorporation of principles associated with Responsible Research and Innovation (RRI). Students are encouraged to evaluate the ethical implications of technological decisions, consider stakeholder perspectives, anticipate societal consequences, and design solutions that balance technological innovation with environmental and social responsibility. These findings indicate a profound redefinition of technological literacy. Rather than preparing future users of technology, the curriculum seeks to educate responsible innovators capable of contributing to sustainable technological futures. Such an educational orientation is increasingly recognised internationally as essential for addressing the interconnected challenges of climate change, digital transformation, biodiversity loss, resource scarcity, and social inequality.

5.8 Implications for "Technology" education in Greece

The findings of the present study have several important implications for curriculum development, teacher education, and educational policy in Greece. These findings agreed with a study completed by Chu, (2020), which mentioned that teacher education is the bedrock of the quality of the educational system of every country.

First, the transition towards competency-based technology education requires a corresponding transformation of classroom practice. Traditional teacher-centred instruction is unlikely to support the inquiry, engineering design, collaboration, and reflective learning envisioned by the revised curriculum. Consequently, sustained professional development should prioritise inquiry-based pedagogy, Engineering Design, formative assessment, Integrated STEM methodologies, and collaborative learning strategies.

Second, successful curriculum implementation presupposes the availability of appropriate learning environments. Technology laboratories should increasingly function as makerspaces supporting experimentation, digital fabrication, prototyping, computational modelling, robotics, and collaborative engineering projects. Without adequate infrastructure, the innovative intentions of the curriculum may remain only partially realised.

Third, assessment systems require substantial redesign. National and school-level assessment practices should evaluate competencies such as creativity, engineering reasoning, collaboration, computational thinking, systems thinking, sustainability awareness, and reflective learning rather than focusing predominantly on factual knowledge or completed artefacts. This finding is in accordance with the aim of Gelen and Cetin, (2022) study, which determines the criteria for establishing the Design and Skill Workshops targeted with the 2023 Vision Document in primary and secondary schools and to present a scientific study on how to create them in schools with application examples.

Fourth, teacher education programmes should incorporate contemporary developments in technology education, including Engineering Design, Integrated STEM, computational thinking, Education for Sustainable Development, and Responsible Research and Innovation. Preparing teachers to facilitate interdisciplinary inquiry will be essential for achieving the curriculum's intended outcomes.

Finally, according to Figure 2, the findings position the Greek Technology Curriculum within broader international curriculum reforms, suggesting that future revisions should continue strengthening interdisciplinary learning, digital competence, sustainability education, and authentic engineering practices while maintaining sensitivity to the cultural and educational context of Greek compulsory education.

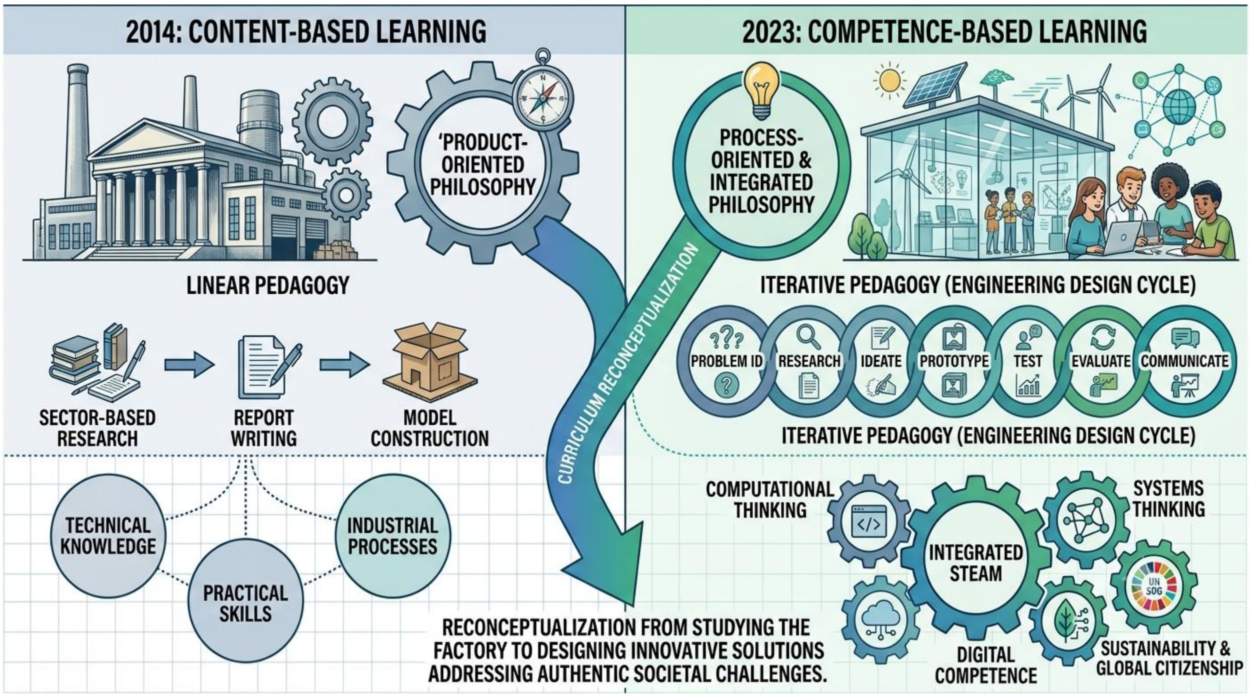

Figure 2: The Greek technology curriculum paradigm shift (Grade 8): Content to competence. (Figure 2 has been created using the Gemini AI tool)

5.9 Theoretical contribution of the study

This section does not merely restate the results. Instead, it explains the new knowledge generated by the present research. The article's most significant finding is not that the 2023 Curriculum is more modern but that the analysis demonstrated that the evolution of the Greek Curriculum took place across three successive levels. Table 13 is the theoretical product of Qualitative Content Analysis. In other words, it is the new model generated by the current research study.

Table 13: Three-level model of Curriculum evolution

Level 1: Epistemological shift	Technology knowledge ↓ Technological competence
Level 2: Pedagogical shift	Individual project ↓ Engineering design Inquiry learning Collaboration
Level 3: Societal shift	Technology for production ↓ Technology for sustainability Responsible innovation Global citizenship

Beyond documenting the differences between the two curriculum documents, the present study proposes a conceptual interpretation of curriculum evolution that may contribute to the international literature on technology education. The qualitative content analysis suggests that curriculum reform occurred simultaneously across three interconnected dimensions, namely epistemological transformation, pedagogical transformation, and societal transformation. Rather than representing independent changes, these dimensions interact dynamically, producing a comprehensive reconceptualization of technology education.

The first level concerns the transformation of technological knowledge itself. The analysis demonstrates a movement from technology as disciplinary content towards technology as competence, integrating knowledge, skills, values, creativity, and responsible decision-making. This epistemological shift reflects broader international transitions from content-based curricula towards competency-based educational frameworks.

The second level involves pedagogical transformation. Technology education evolves from relatively structured individual construction projects towards inquiry-based Engineering Design, collaborative problem solving, computational thinking, and authentic interdisciplinary learning. This transition corresponds closely to contemporary constructivist and sociocultural theories of learning while simultaneously reflecting the principles of Integrated STEM education.

The third level concerns the societal purpose of technology education. Whereas the earlier curriculum primarily emphasised technological understanding and industrial development, the revised curriculum positions technology education as a vehicle for sustainable development, ethical innovation, environmental responsibility, and active citizenship. Consequently, technological literacy is redefined as the capacity to participate responsibly within increasingly complex technological societies.

Taken together, these three transformations form an integrated conceptual model describing curriculum evolution as a multidimensional process extending beyond curriculum content. The proposed model may therefore provide a useful analytical framework for future comparative studies investigating curriculum reforms in other national educational systems.

Qualitative Content Analysis presented in Table 14 leads to a new theoretical model for interpreting the evolution of Technology curricula, organized into three interconnected levels (epistemological, pedagogical, and social). This transforms the current study from a descriptive comparative study into a theoretically grounded, interpretive contribution to the international literature.

Table 14: Proposed model emerging from the qualitative content analysis

Curriculum reform
Educational philosophy
Learning outcomes
Pedagogical transformation
Engineering design
Integrated STEM learning
Computational thinking
Sustainability
Competency-based assessment
Technological literacy
Active global citizen

8. Conclusions

The present study set out to investigate the evolution of the "Technology" course Curriculum for Grade 8 in Greek lower secondary education (2nd class of Gymnasium) through a systematic qualitative comparison of the official curricula introduced in 2014 and 2023. Employing Qualitative Content Analysis as the principal methodological approach, the study moved beyond descriptive document comparison to examine the underlying educational philosophies, pedagogical assumptions, competency frameworks, and policy orientations embedded within the two curriculum documents. The findings consistently demonstrate that the curriculum reform represents a fundamental paradigm shift rather than a simple revision of curriculum content. Across all analytical dimensions-including educational philosophy, curriculum aims, pedagogical practices, Engineering Design, STEAM integration, computational thinking, sustainability, digital competence, and assessment-the 2023 curriculum exhibits a markedly different conceptualisation of technology education from that embodied in the 2014 curriculum. One of the most significant findings concerns the transformation of technological literacy itself. Whereas the earlier curriculum primarily emphasised technological knowledge, practical construction skills, and understanding of technological sectors, the revised curriculum conceptualises technological literacy as a multidimensional competence encompassing inquiry, engineering reasoning, computational thinking, creativity, collaboration, ethical responsibility, systems thinking, sustainability, and innovation. This reconceptualisation reflects broader international developments in technology education and aligns closely with contemporary competency-based curriculum reforms.

A second major contribution of the study concerns the identification of Engineering Design as the organising principle of the revised curriculum. The analysis demonstrates that engineering practices no longer function merely as instructional techniques but provide the conceptual framework through which scientific inquiry, technological creativity, mathematical reasoning, and digital competence are integrated. Consequently, technology education evolves from the study of existing technologies towards the design of innovative solutions addressing authentic societal challenges.

The findings further reveal a substantial pedagogical transformation. Classroom practice shifts from relatively structured individual technological projects and job descriptions in a modern factory-company towards collaborative inquiry, iterative design, reflective learning, and authentic problem solving. Students increasingly assume responsibility for defining problems, generating solutions, evaluating evidence, and improving technological designs through continuous feedback. Simultaneously, teachers transition from transmitters of knowledge to facilitators of learning who support inquiry, collaboration, and metacognitive development.

Another important conclusion concerns the international orientation of the revised curriculum. The analysis demonstrates substantial alignment with major international educational frameworks, including the Next Generation Science Standards (NGSS), Integrated STEM Education, the OECD Learning Compass 2030, UNESCO's Education for Sustainable Development framework, Responsible Research and Innovation, DigComp, and DigCompEdu. This finding indicates that the Greek curriculum for the "Technology" course of 8th grade (2nd class of Gymnasium) reform forms part of a broader global movement towards competence-based technology education designed to prepare learners for increasingly complex technological societies.

From a theoretical perspective, the study contributes to curriculum research by demonstrating how national curriculum reforms can be interpreted through multiple complementary theoretical lenses. Constructivism explains the shift towards inquiry and knowledge construction; sociocultural theory elucidates the growing importance of collaboration and learner agency; constructionism highlights the role of engineering design and technological artefacts in conceptual development; while Integrated STEM theory, Engineering Design, and sustainability frameworks provide broader explanations for the interdisciplinary and competency-based orientation of the revised curriculum.

The study also carries important implications for educational policy and practice. Successful implementation of the revised curriculum will require sustained investment in teacher professional development, particularly in Engineering Design, Integrated STEM, inquiry-based learning, formative assessment, computational thinking, and sustainability education. Furthermore, schools will require learning environments that support collaborative design, digital technologies, prototyping, experimentation, and authentic technological problem solving. Without corresponding changes in instructional practice and assessment, the transformative ambitions of the curriculum may not be fully realised.

Despite these contributions, several limitations should be acknowledged. First, the analysis focuses exclusively on official curriculum documents and therefore does not examine curriculum enactment within classroom practice. Future research should investigate how teachers interpret and implement the revised curriculum across diverse educational contexts. Second, the present study analyses only the Grade 8 of the "Technology" course Curriculum. Comparative investigations encompassing all grades of lower secondary education (Gymnasium) would provide a more comprehensive understanding of curriculum coherence and progression. Third, although the study interprets the curriculum through multiple international theoretical frameworks, empirical classroom studies remain necessary to evaluate the extent to which the intended pedagogical transformation translates into students' learning experiences and educational outcomes. Our concern centers on which teachers will teach it, in what setting, and under what conditions as well as who the students studying it will be. If the institutions have properly prepared future teachers for this significant undertaking, and if the groundwork has been laid at the primary level for future students, their parents, and society at large, then there is no limitation.

Future research could therefore adopt mixed methods approaches combining curriculum analysis with classroom observations, teacher interviews, student perspectives, and assessment data. Comparative international studies examining technology curricula across European educational systems would also contribute to a deeper understanding of the relationship between national curriculum reform and global educational trends. Finally, longitudinal investigations evaluating the long-term impact of Engineering Design, computational thinking, and sustainability education on students' technological literacy would provide valuable evidence for future curriculum development.

In conclusion, the present study demonstrates that the evolution of the Greek Curriculum for the “Technology” course of 8th Grade (2nd class of Gymnasium) reflects a comprehensive educational transformation characterized by the integration of competency-based learning, engineering design, interdisciplinary STEM education, sustainability, and responsible innovation. The reform therefore represents not merely a revision of curriculum content but a reconceptualization of the educational purposes of technology education within the 21st century. As such, it offers a valuable case study of curriculum evolution within an international context and contributes to the growing body of research examining how national education systems respond to contemporary technological, environmental, and societal challenges.

Supplementary Materials
Not applicable.

Authors’ Contribution
Conceptualization, S.L., and I.S.; investigation, S.L., I.S., V.Ch., V.L.; writing-original draft preparation, S.L., I.S., and V.Ch.; writing-review and editing, S.L. I.S., and V.Ch.; visualization, S.L, I.S., V.L., and V.Ch.; supervision, S.L. All authors have read and agreed to the published version of this manuscript.

Funding Statement
This research received no external funding.

Institutional Review Board Statement
Not applicable.

Data Availability Statement
Not applicable.

Acknowledgments
Not applicable.

Conflicts of Interest Statement
The authors declare no conflict of interest.

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