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ENHANCING GRADE 1 CONCEPTUAL SCIENCE LEARNING THROUGH CURRICULUM INTEGRATION

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I locked myself in the basement with Turkish çay and Northed it-

Enhancing Grade 1 Conceptual Science Learning Through Curriculum Integration

The Graduate School of Education

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by

Dylan Bernard Gromen

In Partial Fulfilment of the Requirements for the Degree of

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İHSAN DOĞRAMACI BILKENT UNIVERSITY

GRADUATE SCHOOL OF EDUCATION

Enhancing Grade 1 Conceptual Science Learning Through Curriculum Integration

Dylan Bernard Gromen

May 2024

I certify that I have read this thesis and have found that it is fully adequate, in scope and in quality, as a thesis for the degree of Master of Arts in Curriculum & Instruction.

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ABSTRACT

Enhancing Grade 1 Conceptual Science Learning Through Curriculum Integration

Dylan Bernard Gromen

MA in Curriculum and Instruction

Advisor: Assoc. Prof. Dr. Jennie Farber Lane

June 2024

Ever wondered how to blend three different educational frameworks into one? This study investigates the steps necessary to integrate the Turkish Ministry of National Education, Cambridge Primary Science, and International Baccalaureate Primary Years Programme standards within Concept-Based Instructional Unit Design. Led by a sagacious teacher-researcher who explicated and validated five Conceptually-Based units with expert interviews, the study revealed an agreement among experts on the practicality and alignment of the units. Recommendations include familiarizing integrators with all curricula, utilizing Concept-Based Instructional Unit Design models, and prioritizing conceptual understanding. The successful integration of eclectic educational structures shows the potential of Concept-Based Instructional Unit Design as a unifying pedagogical approach. The findings of this study carry inherent implications for further educational practice. Moving forward, supernumerary research is warranted to inquest the nuances associated across various educational settings.

Keywords: *Concept-Based Instructional Unit Design, Curriculum Integration, Curriculum Alignment, Concept-Based Planning, Evaluation Research*

ÖZET

Müfredat Bütünleştirmesi Aracılığıyla 1. Sınıf Kavramsal Fen Bilimleri Öğreniminin Zenginleştirilmesi

Dylan Bernard Gromen

Eğitim Programları ve Öğretim Yüksek Lisans Programı

Danışmanı: Doç. Dr. Jennie Farber Lane

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Hiç üç farklı eğitim çerçevesini nasıl bir araya getireceğinizi merak ettiniz mi? Bu çalışma Milli Eğitim Bakanlığı, Cambridge İlköğretim Fen Bilimleri Programı ve Uluslararası Bakalorya İlk Yıllar Programı standartlarının Kavram Temelli Öğretim Ünitesi Tasarımı içinde nasıl entegre edileceğine yönelik gerekli adımları incelemektedir. Bilge bir öğretmen-araştırmacı tarafından yönetilen ve uzman görüşmeleriyle açıklanan ve doğrulanan beş Kavram Temelli ünite ile çalışma, uzmanlar arasında ünitelerin uygulanabilirliği ve uyumu konusunda bir uzlaşı ortaya koymuştur. Öneriler arasında, entegratörlerin tüm müfredatları tanımaları, Kavram Temelli Öğretim Ünitesi Tasarımı modellerini kullanmaları ve kavramsal anlayışa öncelik vermeleri yer almaktadır. Eklektik eğitim yapılarının başarılı entegrasyonu, Kavram Temelli Öğretim Ünitesi Tasarımı'nın birleştirici bir pedagojik yaklaşım olarak potansiyelini göstermektedir. Bu çalışmanın bulguları, ileriye dönük eğitim uygulamaları için doğrudan sonuçlar taşımaktadır. Gelecekte, çeşitli eğitim ortamlarıyla ilişkili nüansları araştırmak için ek araştırmalar gerekmektedir.

Anahtar Kelimeler: Kavram Temelli Öğretim Ünitesi Tasarımı, Müfredat Entegrasyonu, Müfredat Uyumu, Kavram Temelli Planlama, Değerlendirme Araştırması

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CHAPTER 1: INTRODUCTION

Introduction

In the classic fairy tale of Cinderella, there is the famous glass slipper that can only fit one perfectly matched foot. The image of trying to fit multiple feet within a single glass slipper symbolizes a struggle to fit into something when it might not. Much like Cinderella and her two stepsisters attempting to place their foot into a single shoe, educational institutions often have the challenge of doing the same by integrating multiple curricula.

Each of the three feet in the story represents its own shape, size, and nuances. Similarly, each curriculum framework comes with its own unique philosophy, methodology, and objective. At an international school in Ankara, Türkiye, the school pledges to use three separate curriculums in its program implementation. The International Baccalaureate Primary Years Programme (IB PYP) encourages inquiry-based learning and developing international-mindedness; the Cambridge Science curriculum which focuses on academic standards for global examinations, and the Ministry of National Education (MoNE) guidelines that are set for Turkish national curriculum standards. Just as Cinderella and her stepsisters each had different feet, each bringing their own requirements and expectations.

Despite the many differences between the educational structures, educational institutions might liken themselves to an ill-fitting shoe, trying to make room for each framework's foot. The International school in Türkiye, attempts to accommodate these three diverse curricular ‘feet’ within their school ‘shoe,’ but does it culminate into a perfect fit? Or does it result in a situation where a foot is left out?

This thesis investigates combining three curriculums into one. As we unpack this unique undertaking in education, let us remember that Cinderella ultimately found the perfect fit for her foot. Does that mean that educational institutions, like the one in Ankara, Türkiye, can do the same with multiple curriculum integration approaches, too?

Background

At an International school in Ankara, Türkiye, explicitly in the Elementary Program (Grades 1-4), the curriculum approach is designed to blend National Turkish MoNE standards, Cambridge Primary Science Standards, and the IB PYP. The school's goals, standards, and assessments aim for coherence and consistency across the three educational designs. This alignment is guided by a systemic perspective, which accentuates the interconnectedness of various components within an educational system. From this perspective, education is seen as a network of interdependent parts. One slight change to any of the curricula could potentially impact the entire system.

At the school, a systemic view on education is complemented by a humanistic approach to learning. The school adopts teaching methods grounded in inquiry-based methods. Within this educational philosophy, the focus extends beyond academic achievements to nurture student growth and empower agency, encouraging them to take ownership of their learning. Drawing from both systemic and humanistic principles, the school's educational approach reflects a blend of these perspectives. This fusion is in line with McNeil's (2008) conceptualization of a curriculum structure that integrates elements of both systemic and humanistic approaches to education.

Educators and policymakers continue to recognize the importance of breaking down traditional subject boundaries to better equip students for the real world (Viennet & Pont, 2017). This recognition comes from the understanding that students require diverse educational experiences. Thus, exploring emerging educational trends and how stakeholders implement such change is necessary. In this project, we explore this growing trend and the different ways this is perceived, specifically through Concept-Based Learning (CBL) and curriculum integration.

Curriculum

A curriculum is a comprehensive educational plan that can derive from a national, school, or individual school curriculum, depending on the context (Scott, 2008). In education, the alignment of curricular standards significantly shapes practical and comprehensive learning experiences (Sharma, 2024). From this, we can infer that the curriculum is not random, and its creation is intentional. Educational theorists like Dewey, Tyler, and Bruner laid the groundwork for this type of education, lending ideas from philosophy, psychology, and sociology. Dewey represented the pedagogical approach of learning through experience, Tyler valued organization and structure, and Bruner believed in building knowledge through hands-on, active learning (Burns 1991). Dewey's influence reached Türkiye during the reforms of the early years of the Republic. The visionary leader Mustafa Kemal Atatürk remarkably extended an invitation to Dewey, (which he accepted) to provide guidance on educational reforms in Türkiye (Wolf-Gazo, 1996). John Dewey's visit to Turkey in 1924 served as a catalyst for significant changes in the Turkish education system. Turan (2000) revisited *The Report and Recommendation on Turkish Education* prepared by Dewey, and reemphasized Dewey's goal of aligning education with modern, secular, and progressive ideals while contributing to the

broader objectives of nation-building and modernization. Now, a century later, it is worth considering the current position of Turkish schools within the framework of curriculum design.

Diverse groups of theorists have contributed to the continuous ideas and definitions of curriculum. McNeil (2008) identifies four main approaches to curriculum and its development: humanistic, social reconstruction, systemic, and academic. His identification of the approaches to curriculum, and its development, showcases the differing perspectives within educational theory and practice that schools or teachers can implement in schools.

Current research highlights the importance of a flexible curriculum that aligns various subjects of educational content (Korosteleva et al., 2019; Markova et al., 2019; Telyubaeva et al., 2022; Wright, 2018). This recognition illuminates the need to reconsider traditional learning structures of schools and adapt teaching methods to foster meaningful interactions between students and curriculum content. In Türkiye, the national curriculum is centrally organized by MoNE. This body oversees compulsory primary education and facilitates foundational education for children. However, because the International school in Ankara, Türkiye, is a private school, it can use additional educational designs, which offers an opportunity to converge various curriculum development approaches outlined by McNeil (2008).

Ministry of National Education

Türkiye's educational system is intentionally constructed to ensure a solid educational foundation for its children. At the forefront of this effort is the MoNE, which provides compulsory primary education for Grades 1-12. This responsibility falls under the purview of the General Directorate of Basic Education, who delivers a foundational education framework for children (European Commission, 2023). The

early mid-nineteenth century marked the introduction of Türkiye's first general elementary school curriculum (Koc et al., 2007). This initial step laid the foundation for subsequent curriculum design and implementation developments. The latest curriculum introduced in Türkiye is part of an extensive program to reform the educational plan covering five academic disciplines: mathematics, science, social science, life science, and Turkish (Koc et al., 2007). This new curriculum in Türkiye is part of a broader reform effort spanning multiple subjects and reflects a push toward modernizing the country's education. Despite this modernized effort, Yaz and Kurnaz (2020) noted Türkiye's efforts to enhance its science curricula fell short of addressing student needs and interests.

Cambridge Primary Science Curriculum

The Cambridge Primary Science curriculum aims to help students understand the world around them and stay curious about science. It offers a structured planning framework for acquiring key scientific content and skills, starting from a young age. This empowers students to become confident scientists as they grow (Bhatia, 2022). The curriculum is divided into distinct components known as *strands* and *stages*. Each strand covers six main areas that work together to teach science holistically (Cambridge University Press & Assessment, 2023). Each strand has its own learning objectives, which were updated and published by Cambridge in September 2020 for its first teaching in September 2021. These strands are designed for science education to be taught at the primary level (Cambridge International, 2023). The Cambridge Primary Science stages within the school in Ankara have been distributed across different grade levels to align with MoNE standards. Students may encounter content from different stages of the Cambridge curriculum, rather than focusing on the specific stage designated by Cambridge for their grade level.

International Baccalaureate Primary Years Programme

The IB PYP is a globally recognized educational framework designed for students aged 3 to 12. It focuses on the child's overall development, fostering intellectual, personal, social, and emotional growth (International Baccalaureate Organization, 2005). The PYP is part of the continuum of IB programs, including the Middle Years Programme, and the Diploma Programme. The PYP is known for its inquiry-driven approach, where students actively ask questions, explore concepts, and develop their understanding of the world around them (International Baccalaureate Organization, 2005).

Defining Curriculum Integration

The three educational programs of Cambridge Primary Science curriculum, IB PYP, and Türkiye's MoNE curriculum offer different pedagogical approaches to primary education. The school in Ankara is passionate about combining three different curriculums, as they believe it aligns with their mission to provide education of the highest standard. By doing this, the educators attempt to create a more holistic curriculum by merging elements from each program.

Curriculum integration can take several forms, including thematic units, project-based learning, problem-based learning, and team teaching (Beane, 1997; Jacobs, 1989; Jacobson & Wilensky, 2006; Thomas, 2000). Despite the many researchers who support combining curricula, there is no unified definition of curriculum integration (Wall & Leckie, 2017). This lack of consensus creates challenges in developing standardized approaches to assessing the effectiveness of integrated curricula. As a result, educators and policymakers often rely on diverse interpretations of what constitutes curriculum integration.

The versatility of curriculum integration and its meaning can be further understood by examining some of its nuances. In 2021, a progression table of integration, ranging from disciplinary to transdisciplinary approaches, was outlined by Roehrig et al. (2021). Understanding these terms is critical as they provide a framework for educators and researchers to understand and categorize different levels of curriculum integration. The general descriptions of these approaches can be seen in Table 1.

Table 1

Levels of Integration

Type of Integration	General Description
Disciplinary	Content learned in separate disciplinary classrooms
Multidisciplinary	Content learned separately but connected through a common theme
Interdisciplinary	Focus on interdisciplinary content and practices from two or more disciplines connected through a common theme or problem
Transdisciplinary	Promotes higher order thinking and deeper understanding of concepts through the use of open-ended assessments.

Note. From "Understanding Coherence and Integration in Integrated STEM Curriculum" by G.H. Roehrig, E.A. Dare, E. Ring-Whalen, et al., 2021, *International Journal of STEM Education, 8*(2). https://doi.org/10.1186/s40594-020-00259-8. Copyright 2021 by the Authors.

The summary of the different levels of integration helps provide a common language for educators to define terms. Drake (1991) asserts that dissolving boundaries is a key aspect of curriculum design, where multidisciplinary,

interdisciplinary, and transdisciplinary approaches are utilized in curriculum development. This classification helps educators identify the extent to which various disciplines are interconnected within a curriculum and how they will be used. Educators who teach integrated curricula must understand and feel confident integrating various subject areas while maintaining the intentions of a unified curriculum (Meier et al., 1998). Though this classification aids educators with the interconnectedness of various disciplines, it does not offer specific guidance on merging two curricula of the same discipline.

Rationale and Benefits for Curriculum Integration

Though Davies (2010) recommends caution in implementing an interdisciplinary curriculum in education, recent research by Drake and Reid (2020) highlights that curriculum integration aligns with current educational trends. By integrating disciplines within the curriculum, educators can create learning environments that encourage students to explore connections between different subject areas and construct their knowledge collaboratively (Drake & Reid, 2018). This aligns with McNeil's (2008) humanistic approach to curriculum as it advocates for interdisciplinary learning, prioritizing self-actualization, innovation, and creativity. Furthermore, Bacon (2018) argues that an integrated curriculum fosters coherence in education, allowing for a deeper grasp of concepts, by making connections within and across learning areas. This approach encourages interdisciplinary exploration.

Though curriculum integration presents difficulties, (Kneen et al., 2020; Nie, 2021; Ruto, 2022), it also has advantages. Drake (2018) proposed it as an effective solution for teaching and assessing 21st-century capabilities. This helps teachers by offering students chances to develop skills for success in today's world. Wall and

Lecki (2017) indicate its role in fostering a student-centered approach, which promotes meaningful learning experiences. This encourages active student engagement and facilitates deeper understanding by connecting various subject areas with the real world. Bacon (2018) points out that assimilating disciplines into curriculum design benefits interdisciplinary connections via conceptual learning. However, despite the current research supporting curriculum integration, Mnguni (2021) suggests that more research is needed to identify ways teachers can sensibly integrate numerous curriculum ideologies in their teaching.

Problem

In education, curriculum serves as the blueprint for equipping students to navigate the demands of the real world. Many schools grapple with combining all or parts of different curriculums to create a unified educational experience for their students (Venville et al., 2012). Integrating multiple curriculums within an educational program poses challenges (Aslam et al., 2023; Kneen et al., 2020; Merah & Tahraoui, 2014; Wijngaards-de Meij, 2018). Curriculum integration usually involves a team of teachers and administrators working together to prepare a framework that the school can use.

In the case of the International school in Türkiye, three distinct curriculums are being combined: the Turkish standards, Cambridge Primary Standards, and the IB PYP. The school prioritizes MoNE learning objectives as there is a legal requirement to adhere to the educational standards set by the Ministry of National Education.

Within this school, the Cambridge Primary Science curriculum is currently distributed across different grade levels to align with the standards set by the MoNE. However, due to differences between the Cambridge and MoNE standards, some

Cambridge objectives may not directly correspond to MoNE objectives, resulting in some standards not being accounted for. This necessitates careful consideration of how to avoid repeating certain standards or teaching them at different developmental stages concerning the progression grids created to support the Cambridge Primary Science curriculum.

Furthermore, the school has implemented the IB PYP in the elementary school embracing its principles and methodologies to provide an inquiry-based education. However, they face the challenge of aligning their existing teaching practices with CBL and the inquiry-based approach advocated by the IB PYP. While the MoNE and Cambridge curriculum contribute to the content and specific learning outcomes at the International school, the PYP Programme at the school is the overarching structure that guides the teaching methodologies. It should be noted that the international school does not use resources such as the International Baccalaureate Organization's PYP Science Scope and Sequence. Instead, the international school uses aspects from the PYP such as *Theme, Central Idea, Key Concepts, Related Concepts, Learner Profile Attributes,* and *Approaches to Learning Skills* to guide the learning.

Numerous schools try to integrate frameworks and curricula (Drake & Burns, 2004). Though there may be other roadmaps for integrating curriculum, (Shin & Kim, 2021) there is no explicit procedure for merging these three curriculums together. Regardless, the International school in Ankara, Türkiye, must address the complexities of integrating multiple curriculums due to differences in the educational programs. To avoid gaps, steps must be taken to ensure that the programs complement and support each other. Furthermore, it is important that all three programs maintain their original intentions when combined.

Purpose

This research project focuses on integrating three curricula into five units for Grade 1 learners in Türkiye. These include Grade 1 national standards outlined by the Turkish MoNE, Science standards of the Primary Cambridge curriculum, and the internationally acclaimed Primary Years Programme for ages 5-7 of the International Baccalaureate Programme. This research project adopts a *Concept-Based Instructional Unit Design* approach, as outlined in the work of Erickson et al. (2017), to align the three programs. In the first few alignment stages, educators identify the unit and the title, determine the conceptual lens, and select content to support CBL. The principal researcher, as well as other specialists in curriculum alignment, separately completed this preliminary work to ensure objectivity and internal validity in the evaluation. These initial steps guided the research, and ultimately the student learning, in connecting concepts throughout the curriculum unit. By examining the integration of these curricula, the study offers recommendations for how to align the science curriculum across different educational frameworks and to provide insights into curriculum integration practices.

This study seeks to validate the proposed five unit plans while combining three educational structures within a CBL approach. Experts in concepts, science, and MoNE assessed the coherence and alignment of the five fused units. Then the proposed integration will be corroborated through the experts' interviews. There will be no implementation of the units in this research; it will simply be a validation. The interview responses will be analyzed to identify agreement and disagreement among the experts. This study aims to endorse the integrated curriculum's alignment through Conceptual-Based Learning while using educational guidelines and principles to remain true to the school's mission.

Research Questions

This study will be guided by the following research question: What steps can be taken to ensure that *Concept-Based Instructional Unit Design* effectively integrates the standards of MoNE, Cambridge Primary Science, and IB PYP?

Significance

The significance of this research project lies in addressing the challenges faced by the International school in Ankara, Türkiye. The school struggles to effectively teach the diverse content specifications of three distinct curricula and conceptual understanding to its learners. Often, teaching content is done as a stand-alone learning objective, specifically in science. Aligning the content within a CBL approach will improve learning at the International school and the broader educational community.

This research project offers a roadmap for schools worldwide facing similar challenges, providing actionable insights into curriculum integration practices through CBL. When teachers are actively engaged in consolidating curricula, they become curriculum developers and bring their own valuable insights and firsthand experiences (Bouckaert & Kools, 2018). This research intends to show the positive outcomes achievable when educators are given autonomy over planning their own units. Many schools can cultivate improved units using concepts of CBL. Providing an example of how to integrate CBL will supply acumen to future teachers who unify multiple curriculums. This is important to the field of education because teachers do not only teach, but they also develop curriculum (Ben-Peretz, 1980; Do, 2020; Erarslan, 2016; Rowan, 2008; Saifulloh, 2016; Özdemir 2017; Young, 1985). This study hopes to contribute to the integrity among teachers whose roles are also curriculum developers.

Definition of Key Terms

Concept-Based Curriculum: Organizes content based on concepts instead of facts (Erickson, 2007).

Concept-Based Learning: An educational method that emphasizes teaching students so they can apply their learning in multiple situations (Marschall & French, 2018).

Concept: A timeless, abstract, and universal idea that can be applied across different situations, making it transferable (Erickson et al., 2017).

Interdisciplinary: The integration of multiple disciplines or fields of study (Roehrig, et al., (2021).

Integration: Deliberately combining concepts from various disciplines to facilitate deeper understanding and meaningful connections (Beane, 2018).

Validation: A component of curriculum development (Wall, 1972).

CHAPTER 2: REVIEW OF RELATED LITERATURE

Literature Review

In the introductory chapter, Cinderella's Tale was used as a metaphor for the challenges that educational institutions can face when integrating multiple curriculums. As Cinderella's stepsisters struggled to fit their feet into one glass slipper, teachers may also encounter difficulties combining multiple educational frameworks as curriculum developers. At an international school in Ankara, Türkiye, three distinct curriculums try to coexist: the IB PYP, the Cambridge Science Curriculum, and the Turkish MoNE.

This chapter begins with a review of studies related to curriculum integration literature, examining the significance of the teacher's role in this context. Building upon this, the chapter further explores the principles of CBL, including Concept-Based Teaching and Learning, Concepts, Conceptual Understanding, Conceptual Lens, and Conceptual Support for CBL. The aim is to provide a deeper awareness of curriculum integration and CBL for educational practice. In addition to exploring CBL principles, this chapter looks into insights from the literature on curriculum integration and CBL.

In addition to exploring the literature on CBL and curriculum integration, this chapter includes a systematic review of the theses on curriculum development conducted by teacher researchers. The literature in the review was carefully selected to fit the needs of the research. By examining this existing research, this review seeks to provide a deeper understanding of the intricacies and impacts of curriculum integration, particularly in teachers' roles in teaching through concepts. This section

aims to equip educators with beneficial perspectives to enhance teachers' ability to create and accommodate multiple curricula.

Curriculum Integration

Bacon (2018) identifies shifts occurring in the educational curriculum from a focus on content and skills to conceptual understanding. Bacon's perspective suggests concepts have the ability to go beyond individual disciplines; that concepts can even be applied to multiple disciplines. Furthermore, he believes concepts offer a framework for integrating knowledge and understanding.

Beane (1995) strongly favors curriculum integration, using the jigsaw puzzle metaphor to illustrate how disconnected curriculum experiences can be for students and educators. Beane asserts the need for a coherent curriculum and depicts it as, no matter what the parts of the curriculum are, they should contribute to making sense of the whole just like a puzzle. Additionally, the researcher argues that a coherent curriculum involves the visible connection between purpose and everyday learning experiences. This suggests that the integration of curriculum plays a role for meaningful learning to take place.

Despite the challenges of curriculum design through concepts (Sunder, 2016), curriculum integration happens across various levels, reflecting alternatives to educational design (Drăghicescu et al., 2013). These multi-, inter-, or transdisciplinary approaches establish connections between concepts from different disciplines. "Recently, integrated science has become a trending issue in dealing with increasingly complex human daily problems" (Abdurrahman, 2022, p. 183). Having an integrated curriculum gives students a better chance of succeeding in overcoming these complications.

Research shows the benefits of integrating across subjects (Al-Mutawah et al., 2022; Kılıç & Tanriverdi, 2022; Stohlmann et al., 2012). Rather than memorizing facts, a blended curriculum approach pushes for a deeper understanding of concepts by making connections across different disciplines. The potential of a consolidated curriculum can be seen as conceptual when thought of in this manner.

Recently, Marshall (2024) completed a study that utilized a transdisciplinary approach to link sustainability themes into the curriculum. This study focused on teaching students the real-world issues of sustainability. The researcher used different methods for data collection, such as virtual interviews, focus groups, and artifact analysis. The triangulation of this data contributes to the study's trustworthiness and accuracy. The author then planned and carried out a conjoined curriculum. Marshall noted, “By promoting critical thinking, problem-solving, and collaboration across diverse disciplines, the transdisciplinary approach empowers students to become proactive agents of change in their communities and beyond” (p. 11). This study demonstrates the role of systematic data collection and analysis. In addition, it points out that aligning standards across subjects can be effective for curriculum integration.

Integrating Curriculum: The Role of the Teacher

Alsubaie (2016) boldly states that, “Without doubt, the most important person in the curriculum implementation process is the teacher” (p. 106). The author further explains that teachers' other duties include planning, executing, and assessing the curriculum. Since teachers are responsible for introducing the curriculum in the classrooms, the author seems to imply that teachers are central to any curriculum development effort and that teacher involvement is needed for curriculum integration.

Curriculum implementation and integration are complex, requiring teachers to apply skills and knowledge beyond teaching (Cansoy & Turkoglu, 2022). Though Huizinga et al. (2014) supports teacher involvement in curriculum design, they describe challenges teachers often face. Their article expresses problems like a lack of curriculum design expertise, limited ICT knowledge, time constraints, and differing team expectations. Though these are significant problems, the authors seem to express that one of the biggest concerns is appropriate pedagogy for interdisciplinary courses. It is implied that to make progressive efforts in curriculum design and integration moving forward, more support for teachers in improving their curriculum design expertise is needed.

Despite these challenges, we should further examine the importance of support for teachers in curriculum development. Leeman et al. (2020) describes that "Teachers who engage in local curriculum development need to take care of curriculum relevance…They need to connect new curriculum elaborations with the school population and existing school practices and culture" (p. 498). This statement directly connects to the importance of the current study since three existing school curriculums are already in place at the international school.

We can further refer to a study that examined the impact of teachers' involvement in workshops and curriculum learning in schools. Baş and Şentürk (2019) found that teachers participating in workshops and curriculum studies at school led to an increase in job satisfaction and a sense of ownership over the work they produce. The study suggests that teachers' involvement in curriculum development positively impacts the implementation of the curriculum in the classroom. Teachers who felt valued and included in the decision-making process were more likely to embrace and implement the curriculum. This reciprocal

relationship between curriculum development and implementation reiterates the need for teachers to have a voice in shaping the curriculum they are expected to deliver. Though the study states that sometimes the responsibilities of teachers within curriculum development are uncertain, the study shows the importance of empowering teachers to contribute to curriculum design.

Nevertheless, “An organisation, however creative it may be, does not create concepts but provides the environment for concept development and facilitates the process,” (Keinonen, 2006, p. 34). This implies that while an organization can foster creativity and provide conducive environments for student learning, the individuals within that organization, particularly teachers, play the most important role in concept development through curriculum integration. In the end, it is the teachers who shape the educational experience and strengthen interdisciplinary connections for learning.

The Role of Curriculum Developers

Teachers hold significant opportunities to influence curriculum development. This starts in pre-service training, with the implication that it can continue to the end of teachers' careers (Goodman, 1986). Analyzing the literature on this topic, aspects of a systematic review of the literature will be conducted. A systematic review offers a rigorous and structured approach to synthesizing research findings and gives an overview of the current state of the knowledge (Lamé, 2019). Given that the current study is a master's thesis, this review will focus on selected studies conducted by researchers during their graduate work.

The thesis conducted by Özdemir (2017) examines the obligation for high school mathematics educators to unify computer software into their teaching practices in accordance with MoNE. This study concentrates on crafting an inquiry-

based teaching unit tailored for high school mathematics teachers teaching calculus. This initiative by the author shows participation in curriculum development. The research assessed the effectiveness of the created and systemized inquiry-based unit. In-service high school mathematics teachers provided feedback through written surveys. This enabled a thorough assessment of the developed unit. The participants provided valuable insights into the content and effectiveness of the teaching unit, contributing to the research's objectives.

In a doctoral study, Erarslan (2016) evaluated the 2013 second grade English Language Teaching Program that was used in Türkiye. Teacher participants provided insights into the program. One key finding was that teachers expressed concerns about their level of involvement in the curriculum development stages. They suggested that greater participation in these stages could enhance motivation and enable them to contribute more effectively to English teaching. More importantly, for this study, it offered ideas for potential curriculum development and implementation improvements. These refinements include addressing obstacles like connecting the curriculum with the real-world learning environment and comprehensive planning of units. This implies that if an improved and appropriate approach to curriculum development can be established, it can lead to enriched outcomes for students. Overall, the study provided valuable insights into the strengths and weaknesses of teacher involvement in curriculum integration which was conducted by a teacher researcher. These findings can boost the relevance of teachers' involvement in culturally relevant curriculum development and implementation.

Teachers are continuously a factor in curriculum development (Patankar & Jadhav, 2013). In her thesis, Memişoğlu (2020) aimed to create a curriculum unit for

ninth-grade English students after realizing some of the gaps between English and MoNE curriculums. The goal of their study was to merge Sustainable Develop Goals with the English standards. This study was significant to the field of education because of its intent to align educational practices with global sustainable development objectives. Memişoğlu aligned an already existing curriculum, analyzed qualitative data, and gave suggested revisions for future pilot testing. The author contributed to the ongoing improvement of the curriculum which is another example of a teacher as a curriculum developer.

The central concept of teacher involvement in curriculum development is increasingly clear in the review. Teachers influence curriculum development as researchers. By amalgamating insights from these studies, a deeper understanding of how fundamental it is for teachers to be actively involved in curriculum development becomes apparent. This involvement implies opportunity for curriculum coherence and teaching effectiveness.

Given the circumstance of concepts as the focal point in the science curriculum, a *Concept-Based Instructional Design* was chosen for this study. With the foundation set on the implications of concepts, the attention instinctively moves towards comprehending more about this pedagogical approach. It becomes more visible that a firm hold on foundational concepts is essential for the framework. Thus, before examining the methodology of the study, it is provisional to build an understanding of the fundamental principles associated within the *Concept-Based Instructional Design* framework.

Defining Concepts

Concepts serve as keys to understanding in education. However, defining a concept is not so straightforward. In some ways, figuring out a concept is similar to

figuring out the main theme of a story. Just as Cinderella's glass slipper might represent hope, concepts offer a structure for multiple understandings. Therefore, defining a concept involves unraveling its significance as well as its nuanced relevance in the context of learning.

According to Novak (1971), the term concept carries diverse meanings across disciplines in science education literature, and many terms such as “conceptual scheme,” “concept,” “theme,” “organizational thread,” “major generalization,” “major concept,” “fundamental idea,” and “major principle” can be used interchangeably. Teaching concepts continued to evolve over time, creating newer insights.

Erickson (2008) offers a simple definition that will guide our understanding moving forward in this study. Erickson sets forth that concepts should be timeless, abstract, and universal, suggesting their transferability across contexts. This structure implies that conceptual knowledge transcends specific instances, offering learners deeper opportunities for understanding.

Conceptual Understanding

According to Milligan and Wood (2010), conceptual understandings are not fixed or absolute but can be contested and are subject to change. The researchers argue that conceptual understandings are also influenced by the context in which they are applied. These contexts can evolve over time as new knowledge and perspectives emerge, making them timeless. The perspective we gain from the authors is that conceptual understandings are not neutral or objective but are shaped by personal experiences, cultural backgrounds, and societal influences. Building upon this notion, Harrell (2010) maintains the significance of integrated science curriculum implementation stating, “The implementation of an integrated science

curriculum provides a powerful learning experience designed to enhance knowledge and conceptual understanding" (p. 162). With this in mind, educators can be intentional about the methodologies used to blend different curriculum models together.

Conceptual Lens

Exploring science through a conceptual lens provides a more comprehensive understanding of how different scientific ideas connect. Erickson (2002) supports this idea, using a nine-step conceptual design plan to examine national science documents. She finds that these documents, particularly the national science standards, offer a thorough treatment of scientific disciplines from this perspective. Erickson also suggests that school districts can take inspiration from these standards to develop similar approaches across other subjects, supporting the importance of adopting a conceptual frame in shaping curricula. This further enlarges the significance of a conceptual approach in curriculum development and its use in this study.

A conceptual lens, as defined by Erickson (2007), serves as a cognitive framework through which individuals interpret and analyze information. The learners use this information to understand concepts and relationships rather than minute details and facts. The author encourages learners to see beyond facts by emphasizing patterns betwixt concepts. Teaching in this capacity promotes deeper comprehension and knowledge transfer using conceptual lenses since the focus is promoting overall understanding. Recognizing these patterns between concepts aligns with Piaget's theory of constructivism, where learners actively construct their own understanding of new information (Prakash Chand, 2023).

Defining Concept-Based Teaching and Learning

Romy (2021) states that, “Concept-Based classrooms will increase student engagement and lead to deeper levels of learning” (p. 14). This assertion supports Concept-Based Teaching and Learning and its roots in educational history. Hilda Taba, an educational theorist from the 20th century, advocated for a shift in education towards conceptual understanding rather than memorizing facts. Taba was known for her work in curriculum development and instructional design (Krull, 2003). Her educational model continues to be utilized in modern-day (Dingeç et al., 2023; Saeed et al., 2024). This brings relevance to the study as it centers around conceptual understanding.

Further research supports the effectiveness of teaching conceptual knowledge for deeper understanding and idea generation (Medwell & Wray, 2020). In their publication, the authors promote understanding of core concepts rather than rote memorization which echoes that of Taba’s philosophy. The study headlines learning through concepts, allowing students to think critically and creatively. With this skill, learners can connect to big ideas and apply them in a range of scenarios. Based on a literature review by Medwell and Wray (2020), various models of Concept-Based Teaching and Learning are used in their work. The contrasting models offer differing findings regarding their use. Comparing the different models opens the door for academic discourse among educators to discuss the pros and cons of the models regarding the findings. These models are summarized in Table 2, Concept-Based Teaching Models. Remarkably, many different models undertake Concept-Based Teaching and Learning, which elicits the question of which model is most suitable for this study. One could argue about the effectiveness of each of the methods listed in the table.

Table 2

Concept-Based Teaching Models

Concept-Based Teaching and Learning Model	Findings
Applebee curriculum integration model	Emphasizes extended conversations and high-quality language episodes to engage students deeply in subject matter.
5E Teaching Model	Incorporates engagement, exploration, explanation, elaboration, and evaluation phases for comprehensive learning.
Science-Technology-Science Approach	Enhances decision-making and problem-solving skills, particularly in applying basic science concepts to real-world scenarios.
Graphic Organizer Model	Promotes higher order thinking and deeper understanding of concepts through the use of open-ended assessments.
Integrated Curriculum Model	Fosters advanced conceptual knowledge, higher-order thinking, and interdisciplinary connections among learners.
Understanding By Design	Emphasizes backward design to achieve learning objectives, yet limited empirical evidence exists on its effectiveness.
Erickson's Model	Central to the curriculum planning approach of the International Baccalaureate Organization and facilitates conceptual understanding and transfer across disciplines, though implementation challenges exist.

Note. From by J. Medwell & D. Wray, 2020, Concept-based teaching and learning: A review of the research Literature, in L. Gómez Chova, A. López Martínez & I. Candel Torres (Eds), *Proceedings of the 13th International Conference of Education, Research and* Innovation (ICERI2020), (pp. 486-496), 2020, IATED Academy https://doi.org/10.21125/iceri.2020.0144. Copyright 2020 by the Authors.

However, from Medwell and Wray's (2020) review, it is clear that Erickson's model stands out, especially given its alignment with concept development and the International Baccalaureate Programme. This model will be used in this study to help guide the creation of *Concept-Based Instructional Units*.

Support for Concept-Based Learning

Erickson (2002) says, "Conceptual focus enables the achievement of an integrated curriculum. Without this focus on key concepts, we are merely 'coordinating' facts and activities around a topic, ultimately falling short of attaining high-level curricular and cognitive integration" (p. 63). Erickson's point drives home that focusing on big concepts in curriculum design is indispensable and that curriculum is not just about organizing topics. It is about connecting the dots to deepen understanding and build critical thinking skills for students.

CBL stresses understanding overarching concepts that transcend specific subjects or disciplines. This process opens up the opportunity for students to make connections and transfer their learning across different settings. Stern et al. (2017) also discusses understanding fundamental concepts rather than memorizing facts. Pointing out that innovation requires a deep understanding of concepts and that students can gain meaningful insights by organizing knowledge into conceptual frameworks. The work by Stern and colleagues (2017) also suggests that the goal of all learning is transferring the learning to real-world contexts.

Abdumanapovna (2022) supports a Concept-Based approach to curriculum and instruction to increase student engagement and construct knowledge to big ideas. The author's implications of a Concept-Based Curriculum are significant as it provides opportunities for advanced learners to be challenged and to differentiate learning experiences. Moreover, the previous research suggests that focusing on

specific concepts encourages higher-level thinking and problem-solving skills among students.

Meaningful learning entails integrating information into existing concepts, resulting in changes in both existing knowledge structures and newly learned material (Boulding & Senesh, 2019). The authors believe learning based on concepts is more effective than rote learning. Therefore, this assertion complements the argument Abdumanapovna (2022) presented regarding the benefits of a Concept-Based Curriculum for promoting deeper understanding.

Adopting a Concept-Based Curriculum that facilitates learners in summarizing, synthesizing, and organizing key ideas fosters a deeper understanding of learning (Godinho, 2017). This assertation promotes the transition from acquiring isolated facts to developing broader conceptual knowledge and understanding. Additionally, the study underscored the interconnectedness of curriculum, suggesting the importance of alignment and coherence across these areas.

Frameworks for Concept-Based Learning

CBL in science education encompasses varied conceptual frameworks (Novak, 1971). Recognizing the conceptual frame laid out by the author suggests that educators have the opportunity to design learning experiences and units that enable students to actively construct meaning from the information they encounter through conceptual learning. This development of cognition leads to student opportunities to utilize their knowledge across a spectrum of scientific scenarios.

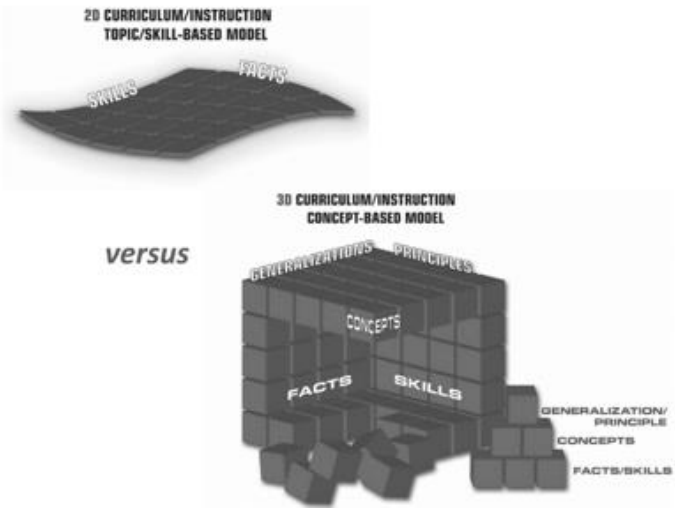
In a study conducted by Tennyson and Park (1980), they state that “most concepts exist, not in isolation, but as part of a set of related concepts” (p. 62). Building on this, CBL, as articulated by Klausmeier (1992), suggests four levels of Concept-Based understanding: concrete, identity, classificatory, and formal. Here,

the learners progress from understanding concepts in specific contexts to achieving deep and abstract comprehension. The study also underlined cognitive growth, as well as conceptual structure, while taking individual learning differences into account. This implies we should acknowledge the interconnected nature of concepts to promote conceptual transfer. This way, learners can apply their understanding of concepts across more than one context over time.

More recently, Erickson and Lanning (2014) took a deeper look into the nature of concepts and conceptual learning. They propose a three-dimensional model of curriculum and instruction, spotlighting the importance of concepts, generalizations (also known as principles), and theories in teaching, which can be seen in Figure 1. The model shows the significance of flexibility in conceptual understanding. Here, it implies the ability to grasp and manipulate abstract concepts in various contexts and situations.

Figure 1

2D vs. 3D Curriculum and Instruction Models



Note. From *Concept-Based Curriculum and Instruction for the Thinking Classroom*, by H. L. Erickson, L. A. Lanning, & R. French, 2017, Corwin https://doi.org/10.4135/9781506355382. Copyright 2017 by the Authors.

The authors distinguish between topics and facts, which are specific and context-bound, and concepts, which the authors define as, “timeless, abstract, universal” (pp. 33-34), which imply transferability (TAUT) across situations. The current study uses Erickson and Lanning's definition of concepts to develop an accurate and thorough model for schools to follow during the curriculum integration process. Their framework demonstrates the importance of overarching ideas that transcend individual subject areas. By leveraging the researchers definition and structure, this ensures that the model is grounded in established educational theory providing a foundation that schools can adapt to various contexts. The model's application is expected to facilitate smoother connections between the three curriculums.

CHAPTER 3: METHODOLOGY

Introduction

Concept-Based Instructional Unit Design focuses on the importance of understanding knowledge and the process structures that are in place for curriculum development (Erickson et al., 2017). This research design will explore this strategy for curriculum integration in more detail, particularly focusing on the merging of MoNE, Cambridge Primary Science, and IB PYP curriculum and standards. This study will use a systematic approach to curriculum unification through a step-by-step process of crafting a Concept-Driven unit as proposed by Erickson et al. (2017). This process will demonstrate how the principal researcher navigated through the thorough and accurate model presented by Erickson and her colleagues. The aim is to see what steps can be taken to align multiple curriculums and to empower other educators to replicate this process successfully when designing Concept-Based units.

Research Design

In this investigation of integrating three curricula for Grade 1 learners in Türkiye, evaluation research is a fundamental opportunity for assessing the validity and effectiveness of curriculum alignment. Progressing from this, Powell (2006) defines evaluation research as a thorough and organized procedure that gathers information to improve understanding and the real-world effectiveness of evaluating it. Wallace and Van Fleet (2001) point out that, “Evaluation is usually undertaken to solve some kind of problem; it is rare and justifiably unusual for anyone to begin an evaluation project solely for the enjoyment of the experience” (p. 5). Basson (2006) proposes that evaluation research should begin with evaluators reflecting on their current practices. While doing so, the evaluators will potentially uncover

inconsistencies and contradictions, leading to new perspectives and a more useful evaluation. This perspective is further investigated by Yilmaz (2021), who agrees with the importance of investigating the opinions of diverse groups of experts to enhance the validity of the educational alignment. By putting into practice evaluation research, this study provides multiple perspectives on a united curricula for Grade 1 learners in Türkiye.

This analysis uses evaluation research to focus on selected aspects of instructional design, which has various methodologies (Andrews & Goodson, 1980). Generally, the development of a curriculum unit involves different phases. Branch (2009) suggests problem identification, planning, production, and evaluation stages. These four steps align closely with the instructional design employed in this review. Memişoğlu (2020) recently utilized an example of this instructional design methodology in their master's thesis. The researcher sought to align the school's English curriculum and standards with the objectives and guidelines of MoNE in Türkiye. Given the nature of those two curricula and their recent successful alignment, it provides a compelling rationale for adopting a similar approach in aligning the Cambridge Primary Science and MoNE standards for Grade 1 under a PYP framework.

Since this research project focuses on developing curriculum units centered on CBL, adopting the outline proposed by Erickson et al. (2017) is appropriate due to its focus on conceptual planning. In their guide to designing *Concept-Based Instructional Units*, the authors focus on curriculum integration and design through interdisciplinary and intradisciplinary means. In the author's book, they outline an eleven-step process to create Conceptual-Based units. This step-by-step, intentional guide for educators in designing instructional units prioritizes conceptual

understanding and critical thinking. In addition, it includes strategies for creating units for students to explore big ideas, make interdisciplinary connections, and make connections to the real world. The suggested approach of creating Concept-Based unit titles first, followed by the identification of conceptual lenses, then alignment of standards may be straightforward for educators who seek to prioritize conceptual understanding.

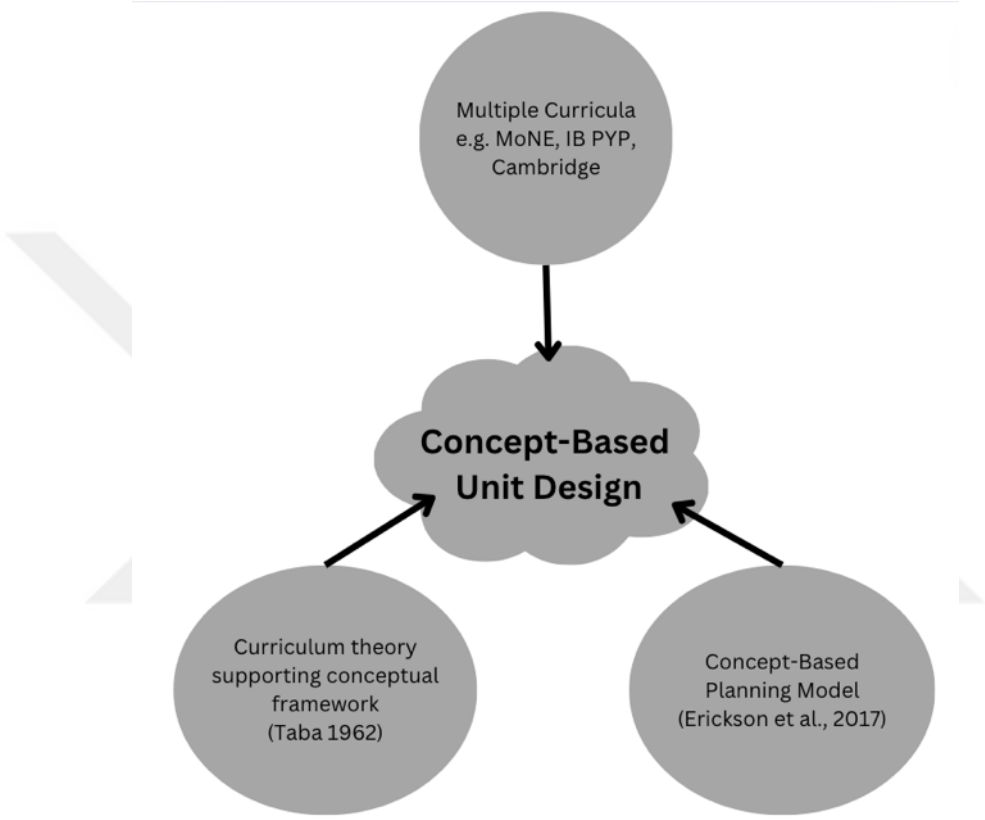
For some teachers, benchmarks drive their teaching. It is important to recognize that the suggested plan and process by Erickson et al. (2017) that will be used in this study may not be as intuitive as expected. Some educators may find it easier to begin by selecting similar standards, identifying a concept that aligns them, and then integrating them into a cohesive unit title with a focus. This suggested integration method basically works in reverse, from the standard selection step to the unit title creation. It is possible that both of these approaches could lead to successful curriculum development and are further explored in Chapter 5. Either way, educators should feel they can adapt the model to suit their individual or school needs. One might wonder if altering the process could deepen the exploration of the relationships between standards, concepts, and instructional units. Though this could lead to more connected learning experiences for students, more research on that approach is needed.

A primary point to consider is that the principal researcher is a teacher and is also a curriculum developer. Teachers have the power to directly impact students in many ways. One of those ways is through curriculum development and implementation. Enhancing educators' knowledge and involvement in curriculum development fosters the effective fulfillment of educational goals (Bano, 2022; Do, 2020; Rimal, 2018; Saifulloh, 2016; Yu, 2023). This study strives to be an example

of how educational professionals can effectively combine curriculum and provide a tool for teachers to plan Conceptual-Based units. Figure 2 shows how I combined the different aspects of this study.

Figure 2

Graphic Organizer of Concept-Based Unit Design



Note. Model created by the author on the 28th of May 2024.

Since the key researcher is a teacher, this study can be viewed through the lens of action research. Harfitt and Chan (2008) state that, "Action research encourages critical reflection, promotes professional dialogues with other teachers, and leads to professional growth and social change" (p. 553). Manfra and Bullock (2014) advocate its capability of bridging the gap between theory and practice and are open to anyone aiming to improve their practice, irrespective of their

circumstances or position. The authors proclaim that action research involves, “A series of steps including posing a question, collecting and analyzing data, and reporting findings” (p. 162).

Action research is part of the teaching profession which involves teachers conducting research to improve their own practice and is valuable to the field of education (Enala et al., 2021; Saribas & Ozer, 2022; Songsee & Nuangchalerm, 2022). Though Aras (2021) states that most schools do not commonly utilize action research among their teachers, this research opens opportunities for teachers to address challenges they face to find solutions by implementing evidence-based strategies.

Teacher research and action research go hand in hand. Promoting teachers to do action research, unlike traditional research conducted by external researchers, supports teacher autonomy of their own professional development. Thus, granting teachers ownership to explore their own questions, gather data, analyze findings, and reflect supports teachers to improve their practice. This reflective cycle implies that action research can meet the needs of schools and their students through professional learning communities.

In conclusion, teacher research as an aspect of action research is a valuable tool for educators to elevate their teaching practice. It allows teachers to actively participate in the research process, investigate specific issues or challenges they face in the classroom, and implement evidence-based strategies to improve student learning (Henthorn et al., 2024). By engaging in action research, teachers can systematically inquire into their practice, make data-informed decisions, and continuously improve their instructional methods (Lufungulo et al., 2021). Teacher

research and action research empower educators to be lifelong learners who are committed to providing high-quality education to their students.

Evaluation and action research in this study centers on the development of curriculum design through concepts. Therefore, this section covers the process for integration, as previously discussed by Branch (2009) and used by Memişoğlu (2020). Their studies suggested four stages; problem identification, planning, production, and evaluation stages.

Pretext for Development

For this study, I used parts of the eleven-step method proposed by Erickson et al. (2017). Though other Concept-Driven planning exists, (Bruner, 1965; Godinho, 2017; Lanning, 2013; Marschall & French, 2018), the framework by Erickson et al. (2017) aligns with the goal of creating Concept-Based Curriculum units for this research. The first step of this research evaluation is to pinpoint the problem. Notably, in Chapter 1 the problem was discussed with integrating multiple curriculums within an international school in Türkiye. By completing this necessary step, preparation was made for the next stages of the research.

Units

Designing units to contribute to a cohesive curriculum involves rigorous planning. I began the process with the creation of unit titles based on the guidelines outlined by Erickson et al. (2017) to serve as the center point for the investigation. This goal of unit titles is to capture the students' attention, while providing an umbrella for clarity and relevance of the content to be studied.

The goal of the titles of the units for the school is to connect to real-life challenges that trigger inquiry and harbor new perspectives for learning. Erikson et al. (2017) assert that weak titles appear too broad or narrow, while strong titles

engage students. Titles need to have enough words to provide clarity and focus. Hence, just using the PYP Transdisciplinary Themes alone (*Who We Are*, *Where We Are in Place and Time*, *How the World Work*s, *How We Express Ourselves*, *How We Organize Ourselves*, and *Sharing the Planet*) is not enough.

Once I determined the units and drafted the unit titles, I selected five of the six PYP Transdisciplinary Themes to be used in the study. I intentionally left out How We Express Ourselves due to the lack of science connections compared to other PYP themes. Though this theme is not included in this research, it is suggested to be included in a yearlong plan and has the capability to be connected to science concepts if desired.

The following step in Erickson and colleagues' (2017) design process is selecting the conceptual lens. This seeks to provide depth and breadth to the unit. It is important to acknowledge here, that the selection of the conceptual lens can alter the total trajectory of the unit, this possibility can shape inquiry learning in different ways. The implication is that educators are able to facilitate deeper connections between ideas by carefully selecting a conceptual lens that aligns with the unit. This strategy positions learners to not only be able to comprehend the individual concepts laid out by teachers but also relate their interconnectedness.

According to Klausmeier (1992), concepts are taught more effectively in sets of two or more related concepts rather than one at a time, allowing learners to discover relationships between the concepts. The PYP offers *Key Concepts* for their units of study that include *Form, Function, Causation, Change, Connection Perspective,* and *Responsibility.* However, for this study, since those key concepts are widely applicable to all of the units, more specific conceptual lenses will be

chosen. By ensuring the quality of the conceptual lens, these units hope to lead to more meaningful learning outcomes for students.

Following this, Erickson and colleagues' (2017) model was used to connect the strands from the Turkish MoNE curriculum to Cambridge Primary Science. For MoNE, all strands were used, *Life in Our School*, *Life at Our Home*, *Healthy Life*, *Safety*, *Life in Our Country*, and *Life in Nature*, but not all standards under the strands were utilized. Some of the Turkish MoNE standards were not included in this study as they were found to be too vague or too specific to effectively synthesize across multiple contexts. They specifically focused on civic education, technology safety, and participation in national events. Though teachers could use those standards to connect to units in the future, the study did not use them for clarity purposes.

After establishing which MoNE standards would be used, I analyzed the Stage 2 Cambridge Primary Science curriculum. Specifically, I focused on the strands *Biology*, *Physics*, *Chemistry*, and *Earth and Space*, which were selected for alignment. It should be noted that the strands of *Science and Context* and *Thinking and Working Scientifically* were intentionally left out in the integration. Working Scientifically, or practicing science, is just as crucial as Biology, Chemistry, and Physics content in the National Curriculum (Johnson & Roberts, 2016). However, this study focuses on integrating the other four strands, setting aside Working Scientifically and Science in Context for now. The reason for this action is due to the fact that Thinking and Working Scientifically, and Science in Context are adaptable and applicable to all of the other strands. This study focuses primarily on aligning the other four Cambridge Science strands to MoNE strands to ensure coherence and integration of specific content within the units.

In the final step of the conceptual development units for this study, I created an overview of the unit's content by brainstorming which topics to place under each strand for MoNE and Cambridge standards. According to Erickson et al. (2017), we can use academic standards, texts, and professional expertise to guide this process. Staying true to this step cements that standards are thoroughly identified and aligned under each of the strands. This process helps strengthen the unit's generalizations and overall continuity. I want to reemphasize that the school intentionally excludes the PYP Science Scope and Sequence from the alignment process. Simply put, the school does not incorporate that aspect of the PYP into its curriculum. Therefore, this study focuses on aligning the units with MoNE and Cambridge standards without considering the PYP science scope and sequence.

Participants and Experts

I contacted multiple individuals in the field of education to assist with the evaluation research. To make this study of value to the field of education, I needed to contact individuals with diverse perspectives and roles to gain insightful analysis of the curriculum integration process. In additional to the internal validator, curriculum integration specialist, and question testers, I chose three experts to validate the units. I deemed three to be an appropriate number of experts because an excessive number of contributors can lead to inefficiencies and conflicting inputs. Ultimately, too many people contributing could complicate the decision-making process. Prior to conducting research, ethical permission was awarded by University’s Institutional Review Board (see Appendix A).

Principal Researcher

I am the lead investigator and principal researcher of this study. I have over ten years of teaching experience and am currently the Science Subject Coordinator at

an international school in Türkiye. The school has taken on the challenge of creating five conceptual-based units infusing more CBL into the curriculum. This goal aligns with the school's Concept-Based teaching philosophy while pursuing alignment with MoNE and Cambridge Science standards. Drawing from my teaching experience in four different countries, I have also assumed the role of curriculum developer in science education in all of my previous jobs. I see this as an opportunity to enhance student learning through concept integration.

This path aims to add to the school's educational environment and empowers teachers to design concept-focused units. These insights are informed by the perspective gained from reviewing the literature in the previous chapter. By integrating concepts into the curriculum, I believe students will benefit from a more holistic learning experience. Ultimately, my hope is that this process will elevate the school's educational quality and support teachers in planning more purposeful and integrated Concept-Driven units.

Internal Validator

To fortify the internal validity of this research, a second educator and colleague, with a background in math and science education volunteered to be a validation assessor. With a decade of teaching experience, the individual has gone through similar Concept-Based planning of units before, and has done so by combining multiple curriculums. Tasked with replicating the principal investigator's process, the internal validator brings valuable insights to this evaluation research process and strengthens the credibility and validity of the study’s outcome.

Curriculum Integration Expert

The lead investigator, in collaboration with an expert in curriculum and instruction, created an instrument for gathering data (Appendix B). The expert has

numerous scholarly contributions to education, particularly in environmental and science education, which bolsters their expertise. Their educational program management leadership and involvement in environmental education initiatives further validate their qualifications. Together, the expert and head researcher developed a questionnaire for collecting data. This data collection tool will serve as the foundational apparatus used in the study.

The questionnaire, with mixed open and closed questions, will be used to gain a frame of reference from other educational specialists in the field and assess the effectiveness of the five pre-made units. This collaboration with the expert was necessary to create a functional instrument for the study. Thus, the specialist's insight into the creation of the questionnaire is considered invaluable.

Questionnaire Testers

The questionnaire testers consisted of five separate evaluators. Their input played a key part in finalizing the evaluation instrument for subsequent use by experts. The professionals' main objective was to check that the questionnaire was clear, concise, and capable of gathering accurate and relevant data. The researcher wanted to recruit volunteers with varied amounts of IB experience to promote an assortment of responses and representativeness in the participant pool. Among these participants were individuals with a range of experience in the IB program and CBL. Their varied backgrounds enriched the study by providing assorted viewpoints from the professionals in the field.

Curriculum Evaluation Experts

After the chief investigator conducted practice interviews, they sought specific experts in the field of education who were relevant to the three different curriculums related to the study. Emails were sent to individuals with experience in

IB, Concept-Based curriculum, Primary Science education, and MoNE, inviting their participation in the study. Participants were explicitly informed via email of the nature of the research and that their involvement was completely voluntary. A consent and confidentiality agreement was provided to all research project participants if they agreed to participate. It specified the study's parameters, and that the expert must be over eighteen to participate. The signed consent forms are included in Appendix C. Before the results of the interviews, some background information on each specialist is provided below.

Concept Curriculum Expert

With over 20 years of experience in education and currently pursuing a PhD, the *Concept Expert* has held many different roles in their career. They have led workshops, carried out research, and contributed to Concept-Based curriculum development through roles like IB Coordinator and Vice Principal. Their commitment to transformative learning is clear in their long-term projects and publications. They are recognized for their expertise with accolades such as Concept-Based Curriculum Integration certification, and they are clearly passionate about impacting education globally. This expert's perspective on the Concept-Based curriculum for five unit plans is pertinent for the study.

Primary Science Education Expert

This experienced *Science Expert* has a decade-long tenure in science education with a mechanical engineering background. They have worked with multiple science curriculums and implemented them in educational settings. Having a master's in the field of education, their wealth of knowledge coupled with their experience, assists in reinforcing the inclusion of the Cambridge Science curriculum

within the study. This expert's insight is valuable to the study due to their extensive knowledge and background in a science context.

IB and MoNE Expert

With a substantial background in Turkish education, International Baccalaureate education, and leadership experience, the *MoNE Expert* has navigated various roles within the IB framework. As an IB Program Leader, Workshop Leader, PYP Coordinator, and School Head for both MYP and DP programs, their deep understanding and direct involvement in the IB curriculum are unparalleled. Backed by an MA in Advanced Leadership and IB certification, they are an authority in educational leadership and IB curriculum development. The expert's background is indispensable due to their nuanced understanding of the contextual intricacies of the IB and Turkish education system.

Instrumentation

The principal researcher, in collaboration with the Curriculum Development Expert, developed an instrument to facilitate effective input from the experts. This instrument had two parts. One part was designed to provide specific insights regarding the content of the curriculum guide. The second part included open-ended questions about the overall perceptions of the guide.

The first part of the analysis asked the evaluator to assess the conceptual lens for each of the different units in terms of timelessness, abstractness, universality, and transferability. Each aspect is rated on a scale of 1 to 3, with 3 indicating strong agreement with the statement, while 1 indicates disagreement. This scale was intentionally chosen due to the nuanced implications of concepts through TAUT. Validators agreed that the scale was appropriate because the aspect of TAUT would

be connected, semi-connected, or not connected at all. Afterward, there is an optional space to provide further justification for the evaluator's answers.

Once the expert reviewer assessed the conceptual lens, they were asked to evaluate the connection between the conceptual lens and its support of the unit focus and aligned standards (MoNE and Cambridge Science). Critics were asked to rate their level of agreement, for both questions, on a scale of 1 to 5 from “Strongly Agree” to “Strongly Disagree” in all five sections for each unit. This scale was deemed appropriate by validators because of the number of standards and their flexibility with the alignment. Again, there was an opportunity to provide further explanation for their responses if needed.

The ensuing section adapted a validated questionnaire developed by Ziolkowski (2007). The questions aimed to gather feedback on Erickson and colleagues’ (2017) modified guide designed to support educators in combining specific learning objectives of the three curriculums and provide further observations from the experts if necessary.

Internal Validator Standard Alignment

The internal validator went through the same scrupulous steps as the principal researcher to evaluate the alignment process of the standards in the units. This involved an analysis of whether each standard exhibited a 'Direct or Indirect Connection, a Vague Connection, or No Connection at All' to the conceptual lens or unit. The groundwork for this assessment had been laid in the previous steps and can be seen in Appendix D.

The process involved categorizing standards based on their relevance to the conceptual lens and unit. This evaluation was conducted individually, without

collaboration among any other colleagues or the principal investigator. The results of the validator can be seen in Appendix E.

Questionnaire Testers

IB educators who were all volunteers, tested the questionnaire before the actual research was conducted with the experts. This step is significant as it helps to ensure the instrument's reliability. It also allowed the participants to share their feedback on the questionnaire and hoped to help make the future interview process smoother for the lead researcher.

First, a review of the content of the questions took place for each section. This full and detailed examination of the instrument intended to confirm that the questionnaire was free from any ambiguity or bias. The examiners also checked if the questions were relevant to the research objectives and if they could gain the desired responses from the experts who would be interviewed later. This assistance ensured that the questionnaire accurately measured its intended outcomes.

In addition to reviewing the questions, the examiners also helped to validate the options provided and response scales for each question. This task assisted the study as participants could provide accurate answers without confusion or difficulty. The reviewers verified whether the questionnaire flow was logical and whether participants could navigate the tool with the interviewer. This step helped identify any issues that may have affected the data collection process via verbal means. The questionnaire was completed through pilot testing with these participants. Piloting the instrument with professionals allowed the lead investigator to practice the interview and pinpoint any shortcomings in the questionnaire design or instructions. Based on the pilot testing results, the researcher made necessary revisions and improvements before completing the expert interviews.

Feedback on the Questionnaire and Interview Process

The evaluators confirmed that the instrument would successfully gather the desired information and meet its intended data collection objectives. Suggestions were provided by the professional to develop clarity in the questionnaire, such as bolding keywords and providing definitions for keywords. Some professionals felt these edits were unnecessary since the questions would be asked verbally. The feedback was obtained through one-on-one conversations and small group discussions.

Feedback on Conceptual Lens

Overall, the professionals who examined the conceptual lenses promoted their use for the study. Some examiners noted that some of the conceptual lens lacked the desired level of abstraction for units. Despite this, after analysis of the five unit's contents, and further conversations with the principal researcher, the evaluators believed these concepts were collectively aligned with standards and unit focus for each unit.

Questions Raised

A coordinator from the Primary Years Programme (PYP) suggested rewording one of the questions in the instrument from "Will this guide help teachers implement CBL objectives in the PYP?" to, "Will this guide help teachers implement CBL methodologies in the PYP?" The coordinator also indicated some doubts about the limitation of the study since it only focuses on Cambridge Science standards and MoNE and no other subjects like math and Turkish language objectives.

Response

The feedback from the qualified individuals suggests that the guide adequately addressed CBL methodologies for science, and MoNE standards. It is

worth noting that the suggested edits by the analysts, including the PYP coordinator's concern regarding the guide's wording and scope, are valid and should be deliberated. Ensuring that future instruments align with a larger range of subjects beyond just Cambridge Science and MoNE could be explored in future studies.

The experienced testers' discourse is significant to establish that the questionnaires are well-designed and capable of capturing desired data. Their amination of the content by the testers of the study contributes significantly to the research's success by enabling the researcher to collect and analyze accurate data from the experts.

Data Collection

In this study, data collection is imperative to understand the instructional design. Therefore, an instrument as the main data collection method was created to maintain an all-inclusive view of the alignment of the three curricula. The instrument's design allowed for quantitative and qualitative data to be amassed and analyzed to bring insights into the research question. However, the limitations of this method are recognized and further expanded upon in Chapter 5. Due to the potential limitations of the instrument, a supplementary tool of interviews was utilized.

For the data collection phase of the research to commence, participants were initially contacted via email to schedule interviews. Once a time was set and consent was given, the data collection process could begin. I conducted three, one- to two-hour long semi structured interviews with the participants during the data collection process. These interviews were designed to gather data to supply more in-depth perceptions and outlooks on the aligned units. I opted not to record the interviews to maintain participant comfort. Instead, I used Google Forms for recording data. This

allowed me to pick up the main details discussed during the interviews. Additionally, some handwritten annotations were taken to add to the documentation.

While this approach lacked verbatim transcripts, I implemented a two-step check in the validation process. First, a tenured educator in curriculum design and teaching was asked to cross-reference the data collected and compare it to the results. They concurred with the findings. Additionally, the experts that were interviewed were sent a copy of their responses to check and validate that voices were accurately represented during interview. This process involved sharing the interview notes with the participants for their review. Further, the experts' responses in Chapters 4 and 5 were sent to them to confirm that their feedback was accurately portrayed in the final analysis. This augmented the credibility of the findings.

Though the interviews were not recorded, this limitation was overcome by organizing a member check process to validate the collected data. This prioritized participant comfort and maintained their confidentiality. This extensive procedure helped to support the fact that the findings are reliable and presents transparency in this study.

Data Analysis

In a study where the teacher is also the researcher, it is imperative that the teacher uses a model that follows a research-backed method. Through the use of a qualitative research method, the main researcher aspired to understand the experts' experiences with CBL units in science education by combining three curricula. Whether the experts were familiar with this integration or not, they could contribute to curriculum design for other educators to use in the future.

In recent years, there has been a shift towards participatory qualitative research methodologies in education, exemplified by thematic analysis. Thematic

analysis focuses on analyzing information shared by individuals about their experiences, which is flexible (Squires, 2023). Thematic analysis stands out due to its applicability to a broad range of subjects and its adaptability to various theoretical frameworks (Braun & Clarke, 2006). Ideally, through thematic analysis, underlying meanings and themes within these conversations will arise. Moreover, its supple nature allows for nuanced exploration, which can capture the richness of the data under study.

To effectively critique qualitative data, certain skills are required. Creswell (2012) outlines six key steps for analyzing and interpreting qualitative data. These steps have been adapted to fit the needs of this research. These fitting steps helped to inspect the qualitative data collected in this study.

Reading over Responses

Initially, I carefully read through the responses provided by all of the experts. I needed to familiarize myself even more with the content and gain more knowledge of the various perspectives shared in the interviews. The Google Form responses were printed out and reread multiple times to assist in this capacity. This allowed for more analysis of the data I collected. I could easily single out differences and compare perspectives from my interviews. I soon realized that reviewing the documents numerous times was becoming an indispensable part of the process, as it led to a more powerful interpretation of the expert interviews.

Coding

After reviewing the responses, I began the process of coding. These codes helped to organize the data more clearly, which allowed for even further analysis than in the previous step. This involved categorizing the responses from the experts based on their significance and connection which can be reviewed in Chapter 5.

Though the instrument required some responses to collect numbers, other aspects had verbal replies. The oral responses enriched the investigation into what the experts were saying to get the main message. Afterwards, I used descriptive codes to summarize the content of each response expressed by expert participants. The codes helped to inform the following stage of interpreting the data, finding themes.

Finding Themes

Once the responses were coded, patterns among the coded segments were identified. Codes with similarities were clustered to create themes reflecting similarities in the data gathered from the specialists. These themes revealed connections from participants' responses. Further details are provided in Chapter 5. As the lead researcher, I found it extremely important to state that even though I conducted the main analysis, it is good practice to substantiate its accuracy by having a colleague review the findings. A peer reviewer assisted in the corroboration of the results derived from the data. By involving another professional in the field of education in the analysis, any potential biases or errors can be addressed. This audit leads to a more full-bodied qualitative analysis to see if they noticed similar codes and themes like I did and provide transparency.

CHAPTER 4: RESULTS

Introduction

This section contains the evaluation of the five carefully crafted curricular units by experts in the field. The detailed units are provided in Appendix F for further examination. The curriculum units were developed using the PYP as a conceptual umbrella, under which the standards of both the Turkish MoNE and Cambridge Science were aligned. The alignment process advocates for cohesion amidst disparate curricular frameworks.

This study is influenced by the views presented by its participants. The contributions from the participants in Internal Validation, Questionnaire Testing, CBL, Primary Science, and MoNE are crucial for this evaluation research. Furthermore, a study analysis was conducted by an educational professional. This heightens the study's credibility. Although these experts share the common objective of analyzing data, each brings a distinct expertise to provide valuable feedback. Together, these professionals in their field offer detailed observations that fortify the results of the research. The evaluators' comments were collected, interpreted, and presented in an overall written report. The reporting aimed to combine the clarity of quantitative data with nuanced interpretations offered in qualitative feedback. The final analysis of expert perspectives on the five units for the year shows parallels between integrated curriculum and design.

Internal Validator

The internal validator and principal researcher underwent the same process to align the unit standards. Yet some divergent results emerged. Notably, the internal validator pointed out certain standards could fit under multiple concepts or units,

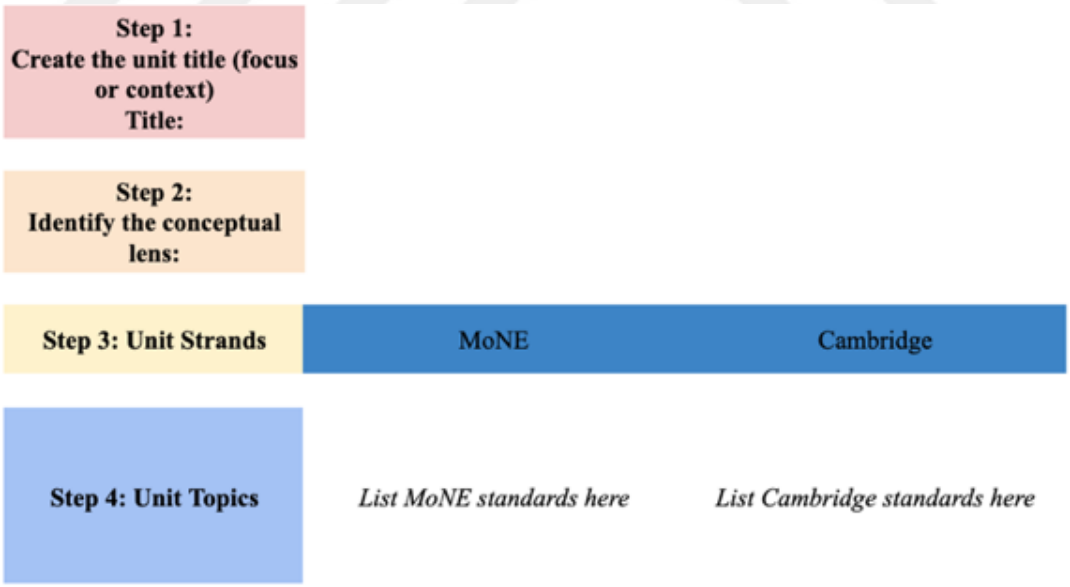
suggesting a potential problem of disparity. However, it is reassuring to mention that the internal validator and the lead researcher conferred to consensus for the units that are proposed for review in this study. This demonstrates an acknowledgment of differences, possibly stemming from varied schemas. This lies in the nuances of conceptual planning with others but an assurance that the final categorization of concepts and standards was deemed logical for the study by the internal validator. They endorsed the units and their alignment and affirmed that they were appropriate to investigate in this study.

Organizing the Data

Erickson et al.'s (2017) structure served as the foundational model for the study.

Figure 3

Structure for Organizing the Unit



Note. Adapted from *Concept-Based Curriculum and Instruction for the Thinking Classroom*, by H. L. Erickson, L. A. Lanning, & R. French, 2017, Corwin, https://doi.org/10.4135/9781506355382

Using the authors blueprint for creating Concept-Based units, the researcher devised a custom framework to combine elements from the three curricula that was endorsed by the internal validator. This framework was subsequently analyzed by experts during interviews, which contained the content of all five units including the conceptual lenses, strands, and associated standards. A blank organizational structure with the completed examples is provided in Figure 3.

Expert Review

Following the methods outlined in Chapter 3, the interview process with experts took place in stages. First, the experts considered the conceptual lens of the unit. After, the conceptual lens was reviewed for its connection to the unit title and focus. Then, the Cambridge Science and MoNE standards were checked to see if there was congruence between the aforementioned steps. This process was repeated for each of the five units. After a review of the five units, an overall evaluation of the units took place. Reviewing the unit's conceptual framework provided rich viewpoints into the study's efficacy and potentiality for implementation. Each expert had the opportunity to justify their responses to each of the three steps mentioned above. This allows for mixed reporting of quantitative and qualitative data from the three experts which provides depth to the study's results.

Expert Review of Conceptual Lens

The academic investigation initially immersed the experts in conceptual thinking and in the definition of a concept according to whether it is TAUT through the questionnaire. Since the primary researcher did not know the extent to which all the reviewers were familiar with Concept-Based Curriculum Instruction, this first step is deemed appropriate. Thus, at the beginning of the study, the researcher procured understanding from the experts in this competence and set the frame of

mind for experts to review the units. Table 3 shows the experts' viewpoints based on the conceptual lens for each unit with a brief summary of the results. The table serves as a reflection of the insights provided by the experts through the lens of conceptual analysis for each of the five instructional units under scrutiny of the experts. Additional elaboration of the findings is located later in the chapter.

Table 3

Expert Review of Conceptual Lens

Unit and Concepts	TAUT Framework	Total Agreement/ Agreement Level	Findings
Unit 1 Environments and Relationships	Timeless Abstract Universal Transferable	3/3 2/3 3/3 3/3	Consensus exists with nuances on abstract notions
Unit 2 Health and Well-Being	Timeless Abstract Universal Transferable	2/3 2/3 2/3 2/3	Moderate agreement.
Unit 3 Identity and Growth	Timeless Abstract Universal Transferable	3/3 2/3 3/3 3/3	Consensus exists with nuances on abstract notions
Unit 4 Interconnectedness and Cycles	Timeless Abstract Universal Transferable	3/3 2/3 3/3 3/3	Consensus exists with nuances on abstract notions
Unit 5 Forces and Responses	Timeless Abstract Universal Transferable	3/3 2/3 3/3 3/3	Consensus exists with nuances on abstract notions

Note. This is the data that was gathered by the author during the interviews with experts.

Further Exploration of Conceptual Lens

Within this section, particular attention is given to the conceptual lenses that have been used in year-long units. Bringing together the ideas that come from

experts, it is hoped that conceptual lenses are seen as effective and relevant in molding the learning process. The author aims to reveal paths toward improving conceptual lens effectiveness by setting up a system where feedback channels are well-examined. There is potential for transformation when it comes to refining these kinds of tools and concepts among educators. This implies that teachers are capable creators of diverse educational contexts. The following sections are a compilation of the experts' responses regarding their feedback on each unit's conceptual lenses.

Environments and Relationships

All experts surveyed agreed or strongly agreed that the conceptual lenses, *Environments and Relationships* supported the Unit, *How We Organize Ourselves: School Safety and Relationships,* along with the aligned standards presented. The *Concept Expert* offered an alternative concept that could better fit the unit, ecosystems. They emphasized the importance of taking care of ecosystems is necessary for positive relationships with our environment. The *Concept Expert* also says that we need to think about learning in ways which promote connection with all living things as well as love relationships rather than fear relationships. On the contrary, the *Science Expert* stresses safety within environments which goes well with the school's culture therefore enhancing respect for nature especially at grade one level. Nonetheless, the *MoNE Expert* insists on curriculum expectations being aligned with the schools' objectives. However, all three agree that safety should be given priority, good relationships should be fostered, and that the curriculum connects learners to real world situations.

Health and Well-Being

All experts surveyed agreed or strongly agreed that the conceptual lenses *Health* and *Well-Being* supported the Unit, *Who We Are: A Healthy Me*, along with

the aligned standards presented. The professionals offered a wide range of views on health and well-being, pointing out their situational significance. The *Concept Expert* emphasizes the macro concepts of health and well-being, suggesting their broad applicability within educational frameworks. They offer suggestions that learning areas should include many facets aimed at nurturing wholeness. Following this, the *Science Expert* reflects the broad nature of health that is suitable as a concept. The *Science Expert* grapples with well-being as an appropriate concept as it focuses more on the softer skills which may increase the difficulty making it transferable and the adequacy of assessments in reflecting these standards. The *MoNE Expert* reminds us that personal well-being is comprehensive because it takes care of one's mental, spiritual, and physical aspects too. Therefore, any review of achievements must ensure they are all covered adequately. The *MoNE Expert* stresses the importance of reviewing all the learning outcomes present in the Turkish standards to uphold balanced coverage of all dimensions of well-being.

Identity and Growth

While the *Concept Expert* stance remains neutral pertaining to the alignment of standards with the conceptual lenses *Identity* and *Growth*, both the *Science* and *MoNE Experts* strongly agree that the conceptual lenses proficiently endorse the unit's standards and unit focus of *Where We Are in Place and Time: Understand Myself, My Family, and Others*. However, the *Concept Expert's* perspective sees the importance of personal identity, growth, and contribution within educational frameworks. This is particularly true in relation to other concepts they identified as of home, roles, and responsibilities.

The *Concept Expert* suggests that the lens needs to be tight to focus on more illustrative examples that reflect identity and growth. They are worried that the

requirements give more importance to roles and responsibilities while not adequately reflecting growth and identity. The *Concept Expert* also believes that the transdisciplinary theme, Where We Are in Place and Time: Understanding Myself, My Family, and Others, does not consider the biological viewpoint in the Cambridge Standards. The other objectives seem to focus more on personal identity in relation to culture, politics, and nature.

The *Science Expert*'s point of view on self-identity within cultural, political, or environmental contexts being general over various subjects like economics, mathematics, or biology is contrary to this stance. They observe that the Turkish National Standards concentrate more on cleanliness standards related to family life than anything else whereas some international ones like Cambridge put more weight on biological aspects ignoring entirely other areas linked directly with cultural heritage. They propose more ways of evaluating such principles by drawing connections between living in Turkish society and having a background in science.

The *MoNE Expert* sees that the present unit lacks the conceptual lens of growth. Inserting references to sharing, manners, and routines into it is essential to identity development practice. Additionally, roles played in homes should be elaborated on while sharing different routines so that learners may grow their understandings about other people's points of view. The expert equally stresses planting a sense of international mindedness through which individuals can identify themselves within such globalized settings like international schools. With this understanding in mind, the *MoNE Expert* aims to aggrandize educational practice by promoting a holistic approach to identity development that subsumes both personal growth and societal awareness.

Interconnectedness and Cycles

The unit of *How the World Works: Exploring Nature's Cycles*, receives support from experts, with the conceptual lenses of *Interconnectedness and Cycles.* The *Concept Expert* and *MoNE Expert* strongly agree, and the *Science Expert* acknowledged this agreement. The *Concept Expert* highlights how the curriculum shows interconnectedness and cycles and the relationship between the concepts. However, they are curious about the unit focus, Exploring Nature's Cycle's, and its interrelationship to circuits. They offer some alternative titles to use such as "exploring with rhythm" or "movements of light and dark." These titles would show more clearly the repetitive nature of such movements that is more common in cycles. To make it more holistic, the *Concept Expert* suggests that units should build synergies among them. This would make the unit "more complex and beautiful to awaken potential and possibility for students," said the source. Additionally, the expert discussed selfhood development where positive relations towards oneself, as well as others within the school community, should be upheld during the learning process.

According to the *Science Expert*, there are also certain considerations related to interconnectedness and cycles. They acknowledge the significance of cycles but question the distinctiveness of interconnectedness compared to concepts like environments and relationships. They express concerns about the potential redundancy of emphasizing interconnectedness and suggest exploring alternative terms that better encapsulate the concept. Additionally, the *Science Expert* reflects on the inclusion of electricity in the curriculum, noting its relevance to energy conversions but suggesting potential limitations for higher levels of understanding.

The *MoNE Expert* provides considerations regarding the abstract nature of cycles, particularly for primary students. They observe that cycles may be more readily recognized in mathematical contexts, but less so in abstract terms. They note that concepts like geographical movement and seasons may be better understood by students, as they can relate these cycles to real-world experiences. The *MoNE Expert* highlights a potential gap in understanding abstract cycles, such as those found in history or social science. Overall, they suggest that while students may grasp concrete manifestations of cycles, abstract concepts may require further exploration and explanation for comprehension.

Force and Response

The feedback regarding the alignment of responses with the conceptual lens for the unit focus and the applicable standards exhibited a spectrum of perspectives. These ranged from unequivocal endorsement of the standards and unit focus to degrees of neutrality. From the standpoint of the *Concept Expert*, the focus is on materials, their properties, and their applications. They suggest that this looks at fundamental questions surrounding the origins of materials. It raises implications of human actions like mining, and they advocate for a holistic exploration of forces. This entails both positive and negative aspects between materials, forces, and environmental impact.

Consequently, the *Science Expert* focused on forces. They drew pertinent connections to Newton's laws while endorsing the exploration of the life cycle the materials. They suggest reassessing the conceptual lens better to encapsulate the nuanced dynamic of the relationship of materials in systems.

The *MoNE Expert* elaborated on connecting the unit to sustainable practices. This supports a slightly different outlook on the inherent properties of materials. The

suggestion to reevaluate the initial conceptual lenses intentionally focuses on environmental stewardship which is associated with resource management and usage.

Experts Additional Insights

After reviewing the five pre-made units, the experts shared their perspectives on the overall guide, the units, and their applicability in educational settings. The experts expanded upon the connections to Cambridge science and Turkish MoNE standards and their alignment under the IB PYP Transdisciplinary Themes. Below are the extended responses from the experts who give a frame of reference for understanding the complex creation of units based in concepts and the nuances associated with conceptual planning.

Overview of the Guide

The curriculum guide strongly met the expectations of the three experts. The layout and formatted content were well-organized and offered clear guidance on using the different aspects of the three curriculums. However, the *MoNE Expert* wished to see the inclusion of the PYP scope and sequence for science. The *MoNE Expert* argues that the scope and sequence would further improve the guide and the alignment of the three frameworks. Despite this, the *MoNE Expert* agrees that the guide presented in the interview would cater to the needs of different educators. This assertion shows the connotation and practicality of the guide as a resource for science education.

Assessing the Guide for Curriculum Alignment

The guide's overarching goal to include all three curricula, and possible improvements that could be made, was pointed out by the experts. Though the *Concept Expert* agreed that the guide was useful and helpful for educators, they

noted that there was a need to include both narrow as well as broad concepts. Additionally, the *Concept Expert* suggested incorporating the use of questions on thinking, reflection, and emotional involvement in the planning. Moreover, it was identified that relying only on TAUT may limit the knowledge base in the subject matter. They proposed additional evaluative questions and considered prioritizing standards due to time constraints.

The *Science Expert* confirmed that this guide could be used to achieve CBL objectives and science objectives. The *MoNE Expert* also agrees that the guide meets the science standards. Despite not being used by the school, the *MoNE Expert* highly recommended that the inclusion of the PYP Science Scope and Sequence document should be examined for collaborative analysis. In general terms, the opinions of the three experts reveal how much the guide can contribute to students' understanding across different educational systems in a science context and to teacher planning.

Coverage of Primary Science

The *Science Expert* was impressed by the ample science subject matter that was included in the proposed units for Grade 1. Despite the number of science standards in the units, the *Science Expert* identifies a dearth of chemistry education. They question what other chemistry concepts would emerge with conceptually planned units.

The *MoNE Expert* asserts that the pre-made units have breadth, are engaging, and align with the learning outcomes. They recognize that the principal researcher carefully selected and analyzed the units, concepts, and standards. The *MoNE Expert* did highly caution against creating standalone units. Avoiding isolated learning, through standalone lessons in units, suggests the ability to maintain relevance to a cohesive framework.

Views on Alignment Structure and Science Education

All three experts unanimously agree that the guide will aid educators in systematizing standards to address primary science education concepts and standards. The *Concept Expert* backs the importance of understanding concepts over content. Notably stating that, “concepts are the content” and questions if a different process of planning in school contexts needs to be developed based on concepts and not standards.

The *Science Expert* openly welcomes the inclusion of higher-order thinking and connections to larger concepts rather than rote memorization in the proposed units. They commented on the guide's impact in progressing learning by synthesizing the learning material. The *Science Expert* does caution that sufficient implementation of this learning style requires familiarity with the subject matter by teachers. This is exemplified by the risk of omitting essential interconnections in the teachings themselves. Teachers, “Have to know what they are doing if they are going to use this approach.” This stresses the importance of educators being able to make connections and to model concepts for students effectively. Thus, the *Science Expert* supports the organization of the guide for a deeper scientific understanding through conceptual lenses.

The *MoNE Exper*t acknowledges the blueprint for planning effectiveness for a science curriculum. Supporting the current alignment, the *MoNE Expert* “...would say congratulations. How the two concepts were chosen and complement each other makes the guide organized and easy to follow.” The *MoNe Expert* particularly noted the clear alignment of the Turkish standards. However, potential time constraints materialize with deeper planning procedures and the *MoNE Expert* suggested more

time would be necessary to completely review all MoNE standards and their relevant alignment.

Personal Relevance & Enhancements

Though the *Concept Expert* may not directly use this guide in their line of work, they point out the influence of individual worldviews on concept selection when planning for units. “The treatment of concepts differs based on who is in the room. For example, how does everyone respond to the situation from the starting point and the mindset they bring to this situation?”

The *Science Expert* validates the advantages of cross-curricular approaches to learning, especially in elementary education, stating that, “This would help teachers with interdisciplinary teaching in the lower grade levels.” In contrast, the expert questions of the guide's applicability to higher grades due to the nature of subject segmentation.

The *MoNE Expert* affirms the practical value of the guide. They reiterate that established curriculum models exist and should be used to help synthesize the material of the three different curricula. The *MoNE Expert* echoes the use of the PYP Science Scope and Sequence to help develop the units in a scientific context. Strong agreement on the potential benefits of using this guide in an educational setting exists. Regardless of the agreement, differing perspectives on its practical implementation should be taken into consideration.

CHAPTER 5: DISCUSSION

Introduction

This chapter offers the review of the five units grounded in *Concept-Based Instructional Unit Design* in a science context. Undergoing extensive validation by educational experts, this study posits itself as a viable pedagogical tool for use in a school that looks to combine multiple curricula. The following chapter provides an overview of the study where major findings are identified, implications for practice and research are discussed, and an examination of the limitations is provided.

Overview of the Study

The purpose of this research was to determine what steps can be taken to ensure that *Concept-Based Instructional Unit Design* effectively integrates the standards of MoNE, Cambridge Primary Science, and IB PYP. To investigate this, a systematic literature review to understand the theoretical foundations of Concept-Based instruction and the specific requirements of MoNE, Cambridge Primary Science, and IB PYP standards took place. Units and concepts were identified, and five instructional units were developed based on Erikson et al.'s (2017) *Conceptual-Based Instructional Unit Plan*. Each unit was tailored to align with the learning objectives of each educational framework.

The lead researcher then collaborated with an internal validator, who also knew the three curriculums, and they conferred to consensus on the integration of proposed units that would later be reviewed by experts. Once the units were ready for inspection, the lead researcher and a curriculum expert developed and adapted a questionnaire to be used for the interviews.

The questionnaire was tested by five professionals in the field of education to see if there were suggestions for improvement. This step was also crucial for the principal researcher, who could practice the interviews before asking experts. After the questionnaire was ready, it was submitted to the ethics committee for approval. After approval, three separate interviews took place to evaluate the units with experts.

After analysis of the results, the study confirmed that through evaluation research, there are steps that can be taken to align the three different curriculums. First and foremost, it should be recognized that standards from MoNE and Cambridge Primary Science can be aligned under the umbrella of the IB PYP. The three curricula can be effectively conglomerated using Erickson et al.'s (2017) *Concept-Based Instructional Unit Design* model. Initially, this protocol demands a conscientious review of each step of the first steps of Erickson's and colleagues' model and all the educational frameworks that will be aligned. Once curriculum integrators are familiar with the material, they can begin planning the unit for conceptual understanding through concepts. When concepts are set, calibration of the different standards under the different units can transpire. When units are set, collaboration with professionals in the field, and guidance from experts, can amplify the integration process. Their input can buttress the accuracy of the synthesized units.

Discussion of Major Findings

The researcher, who is also a teacher, underwent the creation and validation of five Conceptually-Based units. First through the design of a curriculum framework that merges IB PYP, MoNE, and Cambridge Science curricula. Then, the researcher thoroughly evaluated the unification of the three educational programs in a science context through expert interviews. This guarantees that the curriculum

materials are educationally sound and academically valid. This process legitimatizes the teacher researcher to make informed decisions about instructional design and for its use in their own school and classroom.

The primary researcher backs the curriculum design by Erickson and colleagues (2017) that other educators can favor when combining multiple curriculums especially in international contexts. A foundational part of this framework lies in the unique cultural and educational backgrounds of the international school involved. By recognizing the diversity in educational systems, educators can accommodate the integration process to suit its specific needs.

Consensus existed among experts in this research study regarding the practicality of the proposed model for integrating three distinct curriculums. This consensus not only validates the viability of the prototype but points out that the Erickson's et al.(2017) design can be used to help schools combine multiple curriculums. This is especially true through yearlong unit designs and the implementation of Concept-Based units in international contexts.

Combining Curriculum

In the current study, the PYP was the major organizer of the units. This acted as an umbrella under which to align concepts with MoNE and Cambridge Science standards underneath. Though there are methods that challenge traditional CBL, (Amer, 2022), other research tends to favor its conventional approach (Ahmed & Lenchuk, 2020; Erickson, 2002, 2007, 2008; Jonassen, 2006; Sjödén et al., 2023). Therefore, assimilating IB PYP, MoNE, and Cambridge Primary Science standards into *Concept-Based Instructional Unit Design* is possible. The forthcoming suggestions are derived through thorough data analysis conducted in this research study. First, integrators should familiarize themselves with the groundwork of all

curricula they wish to combine. Infra, inspect Erickson et al.'s (2017) *Concept-Based Instructional Unit Design* model. Then, use the rooted steps to create the unit's focus. Afterward, plan for conceptual understanding. Thereafter, rectify the standards within the units. For further expansion of unit development, collaborate with other professionals and experts in the field to optimize accuracy.

Conceptual Planning

Conceptual planning can weave a unifying thread throughout the five different units. This thread can link each of the units in the curriculum. Presenting a unified structure in this way boosts critical thinking options for learners (Andayani et al., 2018; Nurhidayat et al., 2023; Sukaesih & Sutrisno, 2017). This active approach to large-scale integration upholds the relevance of connecting concepts across different subjects and other unit concepts (Aydin,2020; Godinho, 2017; Hokanson & Miller, 2009; Lam et al., 2013; Rodriguez et al., 2019; Romey, 2021; Stambaugh & Mofield, 2017). Students that can be taught to recognize the interconnectedness of knowledge can apply them to real-world scenarios (Abdumanapovna, 2022; King & Henderson 2018; Little, 2017; Srinivasa et al., 2022). Thus, year-long units that are related to one another open the door for more holistic learning contingencies.

Holistic Curriculum

Planning Conceptual-Based Units can help learners see the interrelation between different academic topics. Planning and installing this learning methodology invites students to draw parallels to the real world. Rather than teaching subjects in isolation, complete curriculums embolden students to blend different disciplines together. This launches a multi-dimensional educational experience for students.

The research conducted in this study recognized that education should not only focus on academic knowledge but a well-rounded curriculum for individuals

that should include Social-Emotional Learning (SEL). Just as educators develop students academically, they are equally responsible for nurturing their social-emotional selves (McHenry & Kelly, 2023). Schonert-Reichl (2023) verifies this importance, “Today, SEL is no longer seen as an ancillary aspect of classrooms and schools-it is seen as an essential component” (p. 102). Therefore, educators that are involved in curriculum development should consider the evolvement of well-rounded individuals and the wide-ranging components of existence (Billy & Garríguez, 2021; Lewallen et al., 2015; Wing et al., 2001). This discussion requires substantial reflection on pedagogical practices, largely in terms of language use and conceptual framing. This implies a major finding related to the need for educators to scrutinize how their instructional attitudes through teaching concepts shape students' perceptions of the world they live in.

Researcher's Reflection

Empowering more teachers to become curriculum developers and do research enables them to take an active role in shaping educational content. This initiative can lead to more innovative and tailored curricula, just as I have experienced in my own journey. During the research, I needed to acknowledge the demanding schedules teachers face daily. Understanding time constraints of educators and other professionals in the field (Collinson & Fedoruk Cook, 2001), I aimed not for quantity of interviews but quality instead. Intentionally focusing on depth over breadth gave meaningful purpose to each interview conducted. Teachers have a myriad of responsibilities, making them one of most important resources a school has.

Teachers who are active in curriculum development, especially in science, can forge educational environments. The significance of teachers as curriculum developers stresses the importance of collaboration, professional development, and

ongoing reflection in education (Guo & Wang, 2021). Nurturing educators to contribute proactively to curriculum development instills ownership over instructional design. Immersing teachers in this process can prompt them to respond to the dynamic needs of the classroom in real time, improving overall teaching practice. This overture to involve teachers is being responsive to incipient educational trends (Gerard et al., 2022; Mikser et al., 2016; Shawer, 2010, 2017; Wallace & Priestley, 2017). Giving teachers autonomy over their planning also gives way to the possibility of planning for interdisciplinary connections (D'Souza et al., 2021; Haapaniemi et al., 2021; Nowacek, 2007; Petroelje Stolle & Frambaugh-Kritzer, 2014). Planning in this manner is valuable because it promotes innovation among educators and prepares students to take on problems in the real world.

Cooperative planning gives rise to navigating various nuances (Kodkanon et al., 2018). This intricacy became particularly present when working with both internal and external validators. Achieving total alignment can be an obstacle when involving multiple individuals. This is due to heterogeneous interpretations of concepts. Though each participant brings an individual stance on the discussion, it opens the door to influencing the direction of the planning in different ways. Diversity of viewpoints depends on the complexity of the planning process but also presents challenges in achieving unanimous consensus.

CBL can be subjective in the context of planning. These implications allow for flexibility in curriculum and instructional design. However, this versatility of interpretation and implementation of concepts may lead to dissonance among educators. Addressing this conceptual challenge through professional discord is central to the planning process. Additionally, consideration of the content being

taught within the framework of CBL must continue to fulfill the educational objectives set by schools.

Implications for Further Practice and Research

When considering the implications of this study, it became clear that recommendations for implementing the curriculum guide would benefit from concurrent research. Therefore, the implications for practice and research are presented here in tandem. This study offers suggestions for more in-depth investigations of *Concept-Based Instructional Unit Planning* and its nuanced associations. It is warranted to explore the efficacy of unit planning and implementation across diverse educational contexts and its intertwined connotations.

Teacher Training

Not only do teachers need to be trained in how to use unit guides, but they also need to be trained in how to teach conceptually. For teachers to adequately utilize unit guides, it is imperative that they receive proper professional development in their use. Though unit guides are valuable resources that provide a structured framework, they are only as good as the teachers who use them. Educators may struggle to plan conceptually even with a unit guide without appropriate training. Conceptual teaching focuses on crafting an awareness of concepts and principles. If teachers expect their students to think in this way, they, too, must adopt this style of thinking. It is not enough for teachers to simply have access to unit guides.

Research on program design will be needed to ensure the professional development experiences are effective. In addition, teachers can be asked to further evaluate the curriculum and to review the training. Teacher reviews can be used to revise and improve future sessions.

Use of the Planning Guide

The validation process ensures that the five units align with the latest educational standards and best practices. Five Concept-Based units were internally and externally validated by the experts in the educational field. These units could be used to teach conceptually at the international school in Ankara, Türkiye. The units outlined in this study could be invaluable as they provide a common structure for reference and use. Even if they are not used directly, they can be used as a starting point and adapted. If the units are altered, they can be sent out and checked by other educators in the field. This initiative motivates more collaborative feedback among educators regarding conceptual planning. This continuous improvement of curriculum materials brings relevance to educational settings.

Further investigations on whether the model used in this study for integrating multiple curriculums is significant for teachers and their planning. The planning guide assumes the role of a methodical blueprint for educators to align learning objectives across different subject areas whilst permitting an opportunity for deeper learning through concepts. Another opportunity for greater scrutiny of the unit planning would include discovering whether or not working backward and altering the sequence of its initial steps would be efficacious. Focusing the study on the unit's flexibility can show educators the prospective advantages and disadvantages of this planning framework. This would contribute to a more nuanced understanding of instructional design methodologies.

Likewise, planning future units using the PYP Science Scope and Sequence is suggested by the *MoNE Expert* to provide a more rounded science education. Using the science scope and sequence to assist with aligning the three different curricula could prove to be beneficial in establishing a stronger framework for educators to use

for drafting units. Making use of the PYP Science Scope and Sequence can facilitate a seamless integration of scientific concepts across curricular boundaries.

Implementing Units

Further research can be conducted that actively uses the five units planned in this study. It would be worthwhile to determine the sustainability and feasibility of this curriculum integration approach. A year-long research study would identify possible modifications for further classroom planning and implementation improvement. These findings could lead to more informed choices about future curriculum design and instructional practices. Additional studies that could be completed on the results of enacting the year-long units included student engagement, motivation, and student achievement. Doing this specific type of research can uncover barriers educators may face when employing *Concept-Based Instructional Units*. Comprehending the execution of the structured plan can increase targeted support for potential professional development programs.

Other International Contexts

This curriculum integration study validated the feasibility of combining international and national educational frameworks. Further research is still needed to inspect this model's applicability in blending other national and international curriculums. Understanding the effectiveness in alternative contexts can reinforce its worldwide use.

Social Emotional Learning

During the data collection and analysis, it became evident that the importance of Social Emotional Learning (SEL) was a significant finding. Through the conversation with the concept expert, a call for developing clear criteria and further sensitivity analysis is needed within curriculum to help with SEL. It is imperative

for educators to be mindful of the psychological impact their language and the chosen concepts have in shaping young minds. Though this conversation identified a gap in the literature regarding teachers' awareness of relational dynamics and sensitivity training in educational settings, there are studies on SEL to take into consideration for further exploration.

In the realm of education, being a caring teacher goes beyond academic instruction. It involves creating positive relationships and emotional support for students. Gimbert et al. (2021) indicated that there are three areas of where to focus intentionality when developing educators' competence in SEL: modeling positive behaviors, nurturing healthy relationships, and being reflective practitioners. These principles can lead to greater sensitivity analysis within the curriculum and can be further explored with Nel Noddings' perspective on SEL. “Disciplinary and interdisciplinary thinking is actually generated by a thoughtful consideration of what it means to be a caring teacher.” (Noddings, 2012, p. 776). The fusion of caring teaching practices with thoughtful consideration amplifies the impact of disciplinary and interdisciplinary thinking. By reflecting on the ethical implications of teaching methods, educators can approach their profession with dedication to student well-being. This implies that when educators prioritize student well-being through caring teaching practices, it extends to how they create curriculum and teach concepts.

Limitations

This chapter has offered further insights and implications stemming from the previous chapter. It began with an overview of the study, a discussion of major findings, and concludes with implications for further practice and research. This section of the chapter concluded with limitations derived in the study, which could influence the validity and reliability of the findings. The limitations comprise

different variables and are intentionally addressed to uphold transparency and advance the credibility of the researcher's interpretations.

Sample Size of Study

Although this study intentionally had a small sample size to enable deeper discussions of the materials, it should be acknowledged that there are issues with a limited number of participants. When conducting a research study, having a smaller sample size may not gather data that represent the larger population. In this case, the research may be controversial when trying to externally validate the study. Using a small sample size may also increase the risk of sampling bias. This limitation can undercut the soundness of the data collected as well as the robustness of the conclusions determined from the data.

Recordings

Another limitation of this study was not using video recordings for the interviews. It would have been ideal if the participants' interviews could have been video-recorded during the sessions. However, it was a conscious decision not to compromise the natural flow of conversation. The decision to not record the interview paved the way for a purer conversation during the session. Unfortunately, there is no evidence to review the communication that happened. By not having the recordings from the discussion, it could affect the overall credibility and validity of the study. This signifies the importance of considering alternative ways for documentation of communication that happens during qualitative interviews.

New MoNE and PYP Updates

New obstacles may occur in the upcoming 2024 school year in Türkiye for teachers across the country. MoNE aims to turn out new teaching standards for the upcoming school year in Grade 1. It is forecasted that these standards will bring

about substantial changes that will be relevant to the needs of students and society. Additionally, The IB program plans to upgrade the transdisciplinary theme descriptors and introduce new ways of defining concepts. The new descriptors, coupled with a clearer explanation of concepts, will provide a more nuanced understanding of how these themes interconnect and apply to real-world contexts. The introduction of these new elements signifies the IB's commitment to evolving its curriculum to better meet the needs of students and educators.

The new changes could make it difficult for teachers to plan the way they do now. This may require teachers adapt their planning methods to incorporate new standards that align with the new objectives laid out by MoNE and IB. With this change on the horizon, teachers should consider evaluating students' understanding of concepts rather than their ability to memorize information. This shift provides an opportunity to implement the structure of planning that was validated in this study. The frameworks guide can still be maintained with the transition for the new standards and practice set to be released by MoNE and the IB. Who knows, sometimes the best solutions are as clear and fitting as Cinderella’s glass slipper.

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Appendix A

Official Permission from Bilkent University Ethics Committee

Bilkent Üniversitesi
Akademik İşler Rektör Yardımcılığı

Tarih : 18 Nisan 2024

Gönderilen : Dylan Bernard Gromen

Danışman : Jennie Farber Lane

Gönderen : H. Altay Güvenir
İnsan Araştırmaları Etik Kurulu Başkanı

Konu : *"Enriching ..."* çalışması etik kurul onayı

Üniversitemiz İnsan Araştırmaları Etik Kurulu, 18 Nisan 2024 tarihli görüşme sonucu, *"Enriching Grade 1 Conceptual Science Learning through Curriculum Integration"* isimli çalışmanız kapsamında yapmayı önerdiğiniz etkinlik için etik onay vermiş bulunmaktadır. Onay, ekte verilmiş olan çalışma önerisi, çalışma yürütücüleri ve bilgilendirme formu için geçerlidir.

Bu onay, yapmayı önerdiğiniz çalışmanın genel bilim etiği açısından bir değerlendirmedir. Çalışmanızda, kurulumuzun değerlendirmesi dışında kalabilen özel etik ve yasal sınırlamalara uymakla ayrıca yükümlüsünüz.

Kovid-19 salgını nedeniyle konulmuş olan kısıtlamaların yürürlükte olduğu süre içinde, tüm komite toplantıları elektronik ortamda yapılmaktadır; aşağıda isimleri bulunan Bilkent Üniversitesi Etik Kurulu Üyeleri adına bu yazıyı imzalama yetkisi kurul başkanındadır.

Etik Kurul Üyeleri:

Ünvan / İsim	**Bölüm / Uzmanlık**	
Prof.Dr. H. Altay Güvenir	Bilgisayar Mühendisliği	Başkan
Prof.Dr. Haldun Özaktaş	Elektrik ve Elektronik Müh.	Üye
Doç.Dr. Işık Yuluğ	Moleküler Biyoloji ve Genetik	Üye
Dr. Öğr. Üyesi Burcu Ayşen Ürgen	Psikoloji	Üye
Dr. Öğr. Üyesi A.Barış Özbilen	Hukuk	Üye
Prof. Dr. Özgür Ulusoy	Bilgisayar Mühendisliği	Yedek Üye
Dr. Öğr. Üyesi A.Barış Özçelik	Hukuk	Yedek Üye

Kurul karar/toplantı No: 2024_04_18_02 Başvuru No: 539

Bilkent Üniversitesi İnsan Araştırmaları Etik Kurulu Hakkında:

- Kurul aşağıda ünvan, isim, uzmanlık alanı/bölümü belirtilen 5 asli ve 2 yedek üyeden oluşur:

  Prof.Dr. H. Altay Güvenir (Başkan), Bilgisayar Mühendisliği
  Prof.Dr. Haldun Özaktaş, Elektrik ve Elektronik Mühendisliği
  Doç.Dr. Işık Yuluğ, Moleküler Biyoloji ve Genetik
  Dr.Öğr. Üyesi Burcu Ayşen Ürgen, Psikoloji
  Dr.Öğr. Üyesi Arif Barış Özbilen, Hukuk
  Prof. Dr. Özgür Ulusoy (Yedek Üye), Bilgisayar Mühendisliği
  Dr.Öğr. Üyesi Barış Özçelik (Yedek Üye), Hukuk

- Kurul toplantılarına katılamayan asli üyelerin yerine yedek üyeler görevlendirilir.
- Kurul en az 3 üye ile toplanabilir.
- Bir başvurunun onay alması konusunda olumsuz oy kullanan üyeler bunu onay belgesindeki isimlerinin yanına muhalefet notu düşerek belirtirler.
- Bir başvurunun onay alabilmesi için en az 3 üyenin olumlu oy kullanması gerekir. Onay belgesinde isimlerinin yanında muhalefet notu bulunmaması, o üyelerin olumlu oy kullandıkları anlamına gelir.

Appendix B

Instrument for Gathering Data

Enriching Grade 1 Conceptual Science Learning through Curriculum Integration

This project sought to align three curriculums across diverse educational frameworks. Your role is to review the outcomes of the alignment, providing commentary regarding its potential to uphold the educational standards of all three programs and primary science education in general.

1. Name

_____

2. Are you over 18 years old?

Mark only one oval.

- ◯ Yes
- ◯ No

Scale for TAUT Framework for Unit 1: How We Organize Ourselves: School Safety and Habitats

Please evaluate the following, based on the TAUT Concept-Based Framework, to the best of your ability.

Conceptual Lens: Environments and Relationships

3. To what extent do you agree with the following?

The Conceptual Lens (**Environments and Relationships**) are **Timeless**

Mark only one oval.

- ◯ 3-The concept(s) are timeless: relevant across different time periods.
- ◯ 2-The concept(s) shows some degree of timelessness but with minor limitations.
- ◯ 1- The concept(s) are heavily bound to a specific time period.

4. To what extent do you agree with the following?

The Conceptual Lens (**Environments and Relationships**) are **Abstract**

Mark only one oval.

- 3- The concept(s) are abstract and presented in a highly theoretical manner.
- 2- The concept(s) are abstract, with few concrete examples.
- 1- The concept(s) lack abstraction and are primarily concrete and specific.

5. To what extent do you agree with the following?

The Conceptual Lens (**Environments and Relationships**) are **Universal**

Mark only one oval.

- 3 - The concept(s) demonstrate broad applicability across various contexts or scenarios.
- 2 - The concept(s) can be applied to different scenarios, with minor contextual limitations.
- 1- The concept(s) are narrowly applicable and lack universality.

6. To what extent do you agree with the following?

The Conceptual Lens (**Environments and Relationships**) are **Transferable.**

Mark only one oval.

- 3- The concept(s) are highly transferable to different domains or situations.
- 2- The concept(s) have potential applications in other areas or subjects.
- 1- The concept(s) lack transferability and are highly context-bound.

7. Space for further explanation or justification for your answers (optional)

_____

_____

Review of Unit 1 Title- How We Organize Ourselves: School Safety and Habitats

Please answer the follow question to the best of your ability.

8. To what extent do you agree that the standards in the documents you reviewed supported the conceptual lens of environments and relationships?

   Mark only one oval.

   - ◯ Strongly Agree
   - ◯ Agree
   - ◯ Neutral
   - ◯ Disagree
   - ◯ Strongly Disagree

9. To what extent do you agree that the conceptual lens environments and relationships support the unit focus of, "School Safety and Habitats? "

   Mark only one oval.

   - ◯ Strongly Agree
   - ◯ Agree
   - ◯ Neutral
   - ◯ Disagree
   - ◯ Strongly Disagree

10. Space for further explanation or justification for your answers (optional)

_____

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Scale for TAUT Framework for Unit 2: Who We Are: A Healthy Me

Please evaluate the following, based on the TAUT Concept-Based Framework, to the best of your ability.

Conceptual Lens: Health and Well-Being

11. To what extent do you agree with the following?

The Conceptual Lens (**Health and Well-Being**) are **Timeless**

Mark only one oval.

- 3-The concept(s) are timeless: relevant across different time periods.
- 2-The concept(s) shows some degree of timelessness but with minor limitations.
- 1- The concept(s) are heavily bound to a specific time period.

12. To what extent do you agree with the following?

The Conceptual Lens (**Health and Well-Being**) are **Abstract**

Mark only one oval.

- 3- The concept(s) are abstract and presented in a highly theoretical manner.
- 2- The concept(s) are abstract, with few concrete examples.
- 1- The concept(s) lack abstraction and are primarily concrete and specific.

13. To what extent do you agree with the following?

The Conceptual Lens (**Health and Well-Being**) are **Universal**

Mark only one oval.

- 3 - The concept(s) demonstrate broad applicability across various contexts or scenarios.
- 2 - The concept(s) can be applied to different scenarios, with minor contextual limitations.
- 1- The concept(s) are narrowly applicable and lack universality.

14. To what extent do you agree with the following?

The Conceptual Lens (**Health and Well-Being**) are **Transferable.**

Mark only one oval.

- 3- The concept(s) are highly transferable to different domains or situations.
- 2- The concept(s) have potential applications in other areas or subjects.
- 1- The concept(s) lack transferability and are highly context-bound.

15. Space for further explanation or justification for your answers (optional)

_____

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_____

Review of Unit 2 Title- Who We Are: A Healthy Me

Please answer the follow question to the best of your ability.

16. To what extent do you agree that the standards in the documents you reviewed supported the conceptual lens of health and well-being?

Mark only one oval.

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

17. To what extent do you agree that the conceptual lens of health and well-being supports the unit focus of, "A Healthy Me?"

Mark only one oval.

- ◯ Strongly Agree
- ◯ Agree
- ◯ Neutral
- ◯ Disagree
- ◯ Strongly Disagree

18. Space for further explanation or justification for your answers (optional)

_____

_____

_____

_____

_____

Scale for TAUT Framework for Unit 3: Where We Are In Place and Time: Understanding Myself, My Family, and Others

Please evaluate the following, based on the TAUT Concept-Based Framework, to the best of your ability.

Conceptual Lens: Identity and Growth

19. To what extent do you agree with the following?

The Conceptual Lens (**Identity and Growth**) are **Timeless**

Mark only one oval.

- ◯ 3-The concept(s) are timeless: relevant across different time periods.
- ◯ 2-The concept(s) shows some degree of timelessness but with minor limitations.
- ◯ 1- The concept(s) are heavily bound to a specific time period.

20. To what extent do you agree with the following?

The Conceptual Lens (**Identity and Growth**) are **Abstract**

Mark only one oval.

- ◯ 3- The concept(s) are abstract and presented in a highly theoretical manner.
- ◯ 2- The concept(s) are abstract, with few concrete examples.
- ◯ 1- The concept(s) lack abstraction and are primarily concrete and specific.

21. To what extent do you agree with the following?

The Conceptual Lens (**Identity and Growth**) are **Universal**

Mark only one oval.

- ◯ 3 - The concept(s) demonstrate broad applicability across various contexts or scenarios.
- ◯ 2 - The concept(s) can be applied to different scenarios, with minor contextual limitations.
- ◯ 1- The concept(s) are narrowly applicable and lack universality.

22. To what extent do you agree with the following?

The Conceptual Lens (**Identity and Growth**) are **Transferable.**

Mark only one oval.

- ◯ 3- The concept(s) are highly transferable to different domains or situations.
- ◯ 2- The concept(s) have potential applications in other areas or subjects.
- ◯ 1- The concept(s) lack transferability and are highly context-bound.

23. Space for further explanation or justification for your answers (optional)

_____

_____

_____

Review of Unit 3 Title- Where We Are In Place and Time: Understanding Myself, My Family, and Others

Please answer the follow question to the best of your ability.

24. To what extent do you agree that the standards in the documents you reviewed supported the conceptual lens of identity and growth?

Mark only one oval.

- ◯ Strongly Agree
- ◯ Agree
- ◯ Neutral
- ◯ Disagree
- ◯ Strongly Disagree

25. To what extent do you agree that the conceptual lens identity and growth support the unit focus of, "Understanding Myself, My Family, and Others?"

Mark only one oval.

- ◯ Strongly Agree
- ◯ Agree
- ◯ Neutral
- ◯ Disagree
- ◯ Strongly Disagree

26. Space for further explanation or justification for your answers (optional)

_____

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_____

Scale for TAUT Framework for Unit 4: How the World Works: Exploring Nature's Cycles

Please evaluate the following, based on the TAUT Concept-Based Framework, to the best of your ability.

Conceptual Lens: Interconnectedness and Cycles

27. To what extent do you agree with the following?

The Conceptual Lens (**Interconnectedness and Cycles**) are **Timeless**

Mark only one oval.

- ◯ 3-The concept(s) are timeless: relevant across different time periods.
- ◯ 2-The concept(s) shows some degree of timelessness but with minor limitations.
- ◯ 1- The concept(s) are heavily bound to a specific time period.

28. To what extent do you agree with the following?

The Conceptual Lens (**Interconnectedness and Cycles**) are **Abstract**

Mark only one oval.

- ◯ 3- The concept(s) are abstract and presented in a highly theoretical manner.
- ◯ 2- The concept(s) are abstract, with few concrete examples.
- ◯ 1- The concept(s) lack abstraction and are primarily concrete and specific.
- ◯ Other: _____

29. To what extent do you agree with the following?

The Conceptual Lens (**Interconnectedness and Cycles**) are **Universal**

Mark only one oval.

- ◯ 3 - The concept(s) demonstrate broad applicability across various contexts or scenarios.
- ◯ 2 - The concept(s) can be applied to different scenarios, with minor contextual limitations.
- ◯ 1- The concept(s) are narrowly applicable and lack universality.

30. To what extent do you agree with the following?

The Conceptual Lens (**Interconnectedness and Cycles**) are **Transferable.**

Mark only one oval.

- 3- The concept(s) are highly transferable to different domains or situations.
- 2- The concept(s) have potential applications in other areas or subjects.
- 1- The concept(s) lack transferability and are highly context-bound.

31. Space for further explanation or justification for your answers (optional)

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Review of Unit 4 Title- How the World Works: Exploring Nature's Cycles

Please answer the follow question to the best of your ability.

32. To what extent do you agree that the standards in the documents you reviewed supported the conceptual lens of interconnectedness and cycles?

Mark only one oval.

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

33. To what extent do you agree that the conceptual lens interconnectedness and cycles support the unit focus of, "Exploring Cycles?"

Mark only one oval.

- ◯ Strongly Agree
- ◯ Agree
- ◯ Neutral
- ◯ Disagree
- ◯ Strongly Disagree

34. Space for further explanation or justification for your answers (optional)

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Scale for TAUT Framework for Unit 5: Sharing the Planet: Materials and Properties

Please evaluate the following, based on the TAUT Concept-Based Framework, to the best of your ability.

Conceptual lens: Forces and Responses

35. To what extent do you agree with the following?

The Conceptual Lens (**Forces and Responses**) are **Timeless**

Mark only one oval.

- ◯ 3-The concept(s) are timeless: relevant across different time periods.
- ◯ 2-The concept(s) shows some degree of timelessness but with minor limitations.
- ◯ 1- The concept(s) are heavily bound to a specific time period.

36. To what extent do you agree with the following?

The Conceptual Lens (**Forces and Responses**) are **Abstract**

Mark only one oval.

- 3- The concept(s) are abstract and presented in a highly theoretical manner.
- 2- The concept(s) are abstract, with few concrete examples.
- 1- The concept(s) lack abstraction and are primarily concrete and specific.

37. To what extent do you agree with the following?

The Conceptual Lens (**Forces and Responses**) are **Universal**

Mark only one oval.

- 3 - The concept(s) demonstrate broad applicability across various contexts or scenarios.
- 2 - The concept(s) can be applied to different scenarios, with minor contextual limitations.
- 1- The concept(s) are narrowly applicable and lack universality.

38. To what extent do you agree with the following?

The Conceptual Lens (**Forces and Responses**) are **Transferable.**

Mark only one oval.

- 3- The concept(s) are highly transferable to different domains or situations.
- 2- The concept(s) have potential applications in other areas or subjects.
- 1- The concept(s) lack transferability and are highly context-bound.

39. Space for further explanation or justification for your answers (optional)

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_____

Review of Unit Title- Sharing the Planet: Materials and Properties

Please answer the follow question to the best of your ability.

40. To what extent do you agree that the standards in the documents you reviewed supported the conceptual lens of force and response?

Mark only one oval.

- ◯ Strongly Agree
- ◯ Agree
- ◯ Neutral
- ◯ Disagree
- ◯ Strongly Disagree

41. To what extent do you agree that the conceptual lens forces and responses support the unit focus of materials and properties?

Mark only one oval.

- ◯ Strongly Agree
- ◯ Agree
- ◯ Neutral
- ◯ Disagree
- ◯ Strongly Disagree

42. Space for further explanation or justification for your answers (optional)

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Overall Evaluation and Reflection

43. Consider what you expected this guide to contain before you began, especially considering specific concepts or themes from your area of expertise (e.g., primary science education, PYP, MoNE, Cambridge). After completing your review, were your expectations met?

Mark only one oval.

- ◯ Strongly Agree
- ◯ Agree
- ◯ Neutral
- ◯ Disagree
- ◯ Strongly Disagree

44. You may consider all or one of the following based on your area of expertise.

For your reference, copies of the relevant sections from each of the programs is included in this survey.

Will this guide help teachers address concept-based learning objectives of **PYP**?
Will this guide help teachers address the science standards of **MoNE**?
Will this guide help teachers address the science standards of **Cambridge**?

_____
_____
_____
_____
_____

45. Are there any aspects of primary science education that are not covered well enough in this alignment?

_____
_____
_____
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_____

46. Is the organization of the alignment the most useful arrangement for educators? If not, how would you prefer the standards to be organized?

47. Will this guide help educators select and organize standards to address primary science education concepts and standards?

Mark only one oval.

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

48. Please provide your overall comments about the alignment and the extent to which it has the potential to support primary students conceptual understanding of Science.

49. Would you use this guide in the context of your work? If so, how? If not, why not?

50. Please share any suggestions for edits or realignment of the units.

Appendix C

Signed Consent Forms for Participation in Interview Research

Informed Consent to Participate in a Research Study

Study Title: Enriching Grade 1 Conceptual Science Learning through Curriculum Integration

Principal Investigator: Dylan Gromen

You are being invited to participate in a research study. This consent form will provide you with information on the research project, what you will need to do, and the associated benefits and risks of the research. Your participation is voluntary. Please read this form carefully. It is important that you ask questions and fully understand the research in order to make an informed decision.

Purpose: This research study seeks to align three curriculums from diverse educational frameworks, validate the integration through expert surveys, and analyze responses to ensure alignment within a Concept-Based Learning approach while maintaining educational standards and school objectives.

Procedures:
You will be asked to evaluate pre-designed units based on the framework that Erickson, Lanning, and French (2017) presented in "Designing Concept-Based Instructional Units." Specifically, through the TAUT framework, you will assess whether the units meet the concept-based (PYP) criteria. Then, you will determine the alignment of Cambridge Science and M.o.N.E. standards with the units, providing a short response afterward.

Benefits: The significance of this research project lies in addressing the challenges faced by an International School in Ankara, Türkiye, in effectively teaching the diverse content specifications of three distinct curricula. Among the complexities of integrating the three curricula, the school struggles to teach conceptual understanding to their learners. Often, teaching content is a stand-alone learning objective, specifically in science. Aligning the content with a concept-based learning approach will improve the learning at the International School and the broader educational community. This research project offers a roadmap for schools worldwide facing similar alignment challenges. This research will provide actionable insights into curriculum integration practices through designing concept-based instructional units.

Risks and Discomforts
There are no anticipated risks beyond those encountered in everyday life. As with any research involving surveys and evaluations, the risks primarily involve potential discomfort or inconvenience related to the time required to complete the surveys and the cognitive effort needed to evaluate the instructional units. However, efforts will be made to minimize these risks by keeping the surveys concise and ensuring clarity in instructions.

Privacy and Confidentiality
All data collected will be kept confidential by the principal investigator. If needed, pseudonyms will be used in any future publication of this research study.

Compensation

Participants will not be provided with compensation for their participation.

Voluntary Participation

Taking part in this research study is entirely up to you. You may choose not to participate or discontinue your participation at any time without penalty or loss of benefits to which you are otherwise entitled. You will be informed of any new, relevant information affecting your health, welfare, or willingness to continue your study participation.

Contact Information

If you have any questions or concerns about this research, you may contact Dylan Gromen at:

Consent Statement and Signature

I have read this consent form and have had the opportunity to have my questions answered to my satisfaction. I voluntarily agree to participate in this study. I am over 18 years old. I understand that a copy of this consent form will be provided to me for future reference.
Note: Consent will also be indicated at the beginning of the online survey.

_____	_____
Participant Signature	**Date**
_____	_____
Participant Name	**Participant Address**
_____	_____
Witness Signature	**Date**

Compensation

Participants will not be provided with compensation for their participation.

Voluntary Participation

Taking part in this research study is entirely up to you. You may choose not to participate or discontinue your participation at any time without penalty or loss of benefits to which you are otherwise entitled. You will be informed of any new, relevant information affecting your health, welfare, or willingness to continue your study participation.

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Note: Consent will also be indicated at the beginning of the online survey.

_____	_____
Participant Signature	**Date**
_____	_____
Participant Name	**Participant Address**
_____	_____
Witness Signature	**Date**

Compensation

Participants will not be provided with compensation for their participation.

Voluntary Participation

Taking part in this research study is entirely up to you. You may choose not to participate or discontinue your participation at any time without penalty or loss of benefits to which you are otherwise entitled. You will be informed of any new, relevant information affecting your health, welfare, or willingness to continue your study participation.

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Note: Consent will also be indicated at the beginning of the online survey.

_____	_____
Participant Signature	**Date**
_____	_____
Participant Name	**Participant Address**
_____	_____
Witness Signature	**Date**

Compensation

Participants will not be provided with compensation for their participation.

Voluntary Participation

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I have read this consent form and have had the opportunity to have my questions answered to my satisfaction. I voluntarily agree to participate in this study. I am over 18 years old. I understand that a copy of this consent form will be provided to me for future reference.
Note: Consent will also be indicated at the beginning of the online survey.

_____	_____
Participant Signature	**Date**
_____	_____
Participant Name	**Participant Address**
_____	_____
Witness Signature	**Date**

Appendix D

Blank Organizer for Internal Validator

Unit Title	How We Organize Ourselves: School Safety and Habitats		Who We Are: A Healthy Me		Where We Are In Place and Time: Understanding myself, My Family, and Others		How the World Works: Exploring Nature's Cycles		Sharing the Planet: Materials and Properties		DO NOT FIT	
Conceptual Lens	Conceptual lens: Environments and Relationships: The conceptual lens includes understanding the importance of keeping nature and the environment clean, observing animals and plants in their habitats, recognizing the impact of human activity on the environment, caring for animals and plants in the vicinity, and the school environment.		Conceptual lens: Health and Well-being This lens encompasses various aspects of personal care, health precautions, nutrition, food preparation, and media usage. It emphasizes understanding the importance of maintaining personal hygiene, following health precautions, making healthy food choices, managing diet, and using media responsibly.		Conceptual lens: Identity and Growth: This lens encompasses various aspects related to family dynamics, personal relationships, and self-awareness. It emphasizes understanding similarities and differences with peers, describing the growth and development of offspring, and recognizing the combination of features inherited from parents. Additionally, it focuses on introducing and understanding family members, emphasizing the importance of family values.		Conceptual lens: Interconnectedness and Cycles: This lens emphasizes the interconnected nature of natural phenomena and the cyclical patterns that govern them. It encourages students to explore how various elements within Earth's systems interact and influence each other in recurring patterns. By focusing on cycles, students gain insights into the rhythms of nature, such as the seasonal changes, celestial movements, and environmental processes.		Conceptual lens: Forces and Response: This lens focuses on how different forces interact with materials and influence their behavior. It helps us understand how materials respond when forces like pushing, pulling, or gravity act on them. Through this lens, students explore how materials bend, stretch, or stay still when forces are applied to them. They also learn about how materials can be strong or flexible, and how their properties affect how they respond to forces.			
Strands	M.o.N.E	Cambridge	M.o.N.E	Cambridge	M.o.N.E	Cambridge	M.o.N.E	Cambridge	M.o.N.E	Cambridge	M.o.N.E	Cambridge
Standards												

Appendix E

Results of Internal Validator

How We Organize Ourselves: School Safety and Habitats	
Conceptual lens: Environments and Relationships: The conceptual lens includes understanding the importance of keeping nature and the environment clean, observing animals and plants in their habitats, recognizing the impact of human activity on the environment, caring for animals and plants in the vicinity, and the school environment.	
M.O.N.E	Cambridge
HB 1.1.3.Students obey the safety rules on their way to school. It focuses on the basic rules that must be followed in service vehicles, the use of pedestrian crossings, pavements and roads, and what to consider when communicating with someone they know and do not know.	2Bs.01 Compare how animals, including humans, are similar and different in their external body parts and skin covering.
HB 1.1.4.Students find the location of the class in school. Basic concepts about direction; right, left, in front of, behind, under, on, next to, opposite etc. are stressed.	2Be.01 Know that an environment in which a plant or animal naturally lives is its habitat.
HB 1.1.6.Students know how to act in flag raising ceremony. It is emphasizes that it is important to respect to Turkish flag and the Turkish National Anthem.	2Be.02 Know that different habitats contain different plants and animals.
HB 1.1.7.Students recognize departments of the school. Students are shown the place of the class in the school. In addition, other departments are introduced by visiting the administrative part, teachers' room, guidance service, canteen, library, gym, toilets and units in school.	2Be.03 Identify similarities and differences between local environments in terms of hot, cold, dry, wet, many plants, few plants, many animals and few animals.
HB 1.1.8. Student know how to use toilet and follow the rules related with it. It emphasizes the importance of how to use the toilets (Visiting the toilets, asking for permission, being respectful for own ant other's privacy in the bathroom).	2ESp.03 Know that human activity can affect the environment.
HB 1.1.9. They know the school staff members School principal, assistant principals, teachers and other service staff.	
HB 1.1.10. Students receive help from school staff when it is necessary. The circumstances are explained to the students in which they should seek permission and assistance of Teachers, on-duty teachers, servants and administrative staff.	
HB 1.1.11.Students participate in the process of determining in-class rules. It emphasizes the necessity of using the class materials with care, keeping the class clean, paying attention to the timing in communication (listening, talking, speaking on the spot) and not harming the friends and friends' property and keeping the environment clean. It is underlined that the rules of the class are determined with the participation of the students.	
HB 1.1.12.Students obey the rules inside of the school and at the school yard. It focuses on issues such as following stairway up and down rules, not hanging from the window, not touching the cables and plugs, using the school materials carefully and lining up in the classroom, hallway, school garden, dining halls, and while using the trash can.	
HB 1.1.13.Students follow the courtesy rules while communicating in school. It emphasizes the need to use courtesy statements such as "thank you, hello, good morning, good day, goodbye, please, apologize, please" while communicating with their teacher, friends and school staff. It emphasizes the need of permission while entering someone's room (teacher's room, director's room, servant's room, classroom etc.)	
HB 1.1.14.Students take place in-class and in-school activities. It is highlighted that it is important to attend club activities, to participate in school council activities in certain days and weeks.	
HB 1.1.15.Students are willing to take place in the games and playing. Student is guided to have fun with the game, to comply with the rules of the game, to show appropriate behaviors in the game, to make friendships, to define oneself and others.	
HB 1.1.16.Students develop positive feelings and ideas about school. It emphasizes the contributions of the school to individual life (making new friends, playing games, having fun, getting information, etc.) and the sensitiveness to students who may have fear of school.	
HB 1.1.17.Students choose educational tools and materials. The course tools to be used are introduced, focusing on using them correctly, safely and transporting them properly. The use of pens, notebooks and bags is particularly emphasized.	

HB 1.2.3.Students give direction of their houses. It deals with what is next to, in front of, in the face of, behind, on its right and on its left of the house. It is emphasized that the home address of the student and the telephone number of at least one of the family members should be kept in writing and that who is reliable to share this information. In the learning process, drawing a sketch of the environment may be dramatised.	
HB 1.2.4.Students follow courtesy rules when communicating with family members at home. When communicating with family members at home, it emphasizes using a appropriate tone of voice, mimicry and words on the basis of courtesy rules when they deliver their requests and needs, express their feelings, thoughts and wishes. It is emphasized that when entering the room of the other members of the house, permission is required.	
HB 1.2.5.Students use the sources efficiently and properly at home. It mentions the proper use of electricity, water and personal hygiene materials.	
HB 1.4.1.Students follow the safety rules at home and in school. It is emphasized that it is important to carefully climb up and down stairs, to get on the elevator, to walk on wet ground, to be careful while using glazed objects (cabinet, corner of honor, etc.) in the classroom, such as power outlets, cables and not to play with fire, not leaving the water tap open, to recognize cleaning materials and to know what to do in case of gas leakage.	
HB 1.4.2.Students observe traffic rules and behaviours of people in traffic while coming to and from school.	
HB 1.4.3.Students obey the traffic rules. It focuses on crossing over, walking on crosswalk and on road, takining precautions as a pedestrian. It also focuses on knowing what traffic signs (stop, late, pedestrian crossing, attention, school passage, bicycle can not enter) are and what to do in places where there are no signs (lower and upper passages, pedestrian crossings, school crossings, traffic lights and the places where traffic cops are, keeping the distance from a vehicle, etc.)	
HB 1.4.4.Students know how to act to strangers or familiar people around. It emphasizes to reject any offer or intitation that violate their personal right while communicating.	
HB 1.4.5.Students know the telephone numbers of institutions to call to get help in case of emergency. Emphasizing on inconveniency of falsely reporting, emergency numbers of instutitons are introduced (for fire service 110, ambulance 112, police department 155, gendarmerie 156, forest fire 177, and so on.) Telephone numbers are coded in the form of one by one (1-5-5).	
HB 1.4.6.Students use technology safely. The safe usage of electronic devices and devices such as computers, televisions, mobile phones, tablets, gaming consoles and electrical appliances is emphasized. It is highlighted that careful attention should be paid to situations that may lead to technology dependency such as internet and computer games.	
HB 1.4.7.Students recognize safe and unsafe areas for themselves. It emphasizes the importance of being careful in danger areas such as elevators, stairwells, balconies, basement floors of buildings, construction sites, water channels, pits, water deposits and ornamental pools.	
HB 1.5.1.Students recognize general characteristics of the place they live in. They are asked to learn about specific characteristics of the names of family elders, the place they live in (neighborhood / village / district / province), the products grown.	
HB 1.5.2.Students are acquainted with historical and touristic places in which they live.	
HB1.5.3.Students recognize the general characteristics of our country. The name of our country, its capital, the National Anthem and the Turkish flag are introduced. The color of the flag is indicated by emphasizing the moon and star.	
HB 1.5.4.Students realize that they live together with people from different cultures in our country. It introduces people who have emigrated from their countries, either compulsory or voluntarily.	
HB 1.6.1.Students recognize the animals in the environment in which they live. It emphasizes the animals (fish, birds, reptiles, insects, pets, etc.), what they nourish and where they shelter. If observations are made, necessary safety precautions are taken.	
HB 1.6.2.Students recognize the plants in their surroundings. It emphasizes how garden plants, wild plants and trees in their surroundings change over time (plant growth, planting leaves, opening and blossoming, etc.). Observations are considered in this sense.	
HB 1.6.3.Students protect the animals and plants in their surroundings.	
HB 1.6.4.Students keep the nature and environment clean. It emphasizes the actions to be taken to protect the nature and environment and in this sense warning of the society in the frame of courtesy rules.	
HB 1.6.5.Students know the materials which can be recycled. The materials such as plastics, paper, glass and battery are introduced.	

Who We Are: A Healthy Me	
Conceptual lens: Health and Well-being This lens encompasses various aspects of personal care, health precautions, nutrition, food preparation, and media usage. It emphasizes understanding the importance of maintaining personal hygiene, following health precautions, making healthy food choices, managing diet, and using media responsibly.	
M.O.N.E	**Cambridge**
HB 1.2.6.Students make daily planning. It focuses on allocated time to playing games, studying, resting, sleeping, eating, spending qualified time with family and friends, and using mass media.	2Bs.02 Identify the different types of human teeth, explain how they are suited to their functions and describe how to care for teeth.
HB 1.2.7.Students distinguish the differences between wantings and needs.	2Bp.01 Know that humans need to manage diet, maintain hygiene and move regularly to be healthy.
HB 1.3.1.Students maintain their personal care. It focuses on washing hands and face, teeth brushing, bathing, hairdressing, toilet training, wearing daily clothes. It also emphasizes continuity in personal care. When doing personal care, it is mentioned that resources should be used efficiently.	2Bp.02 Describe what illness is and describe the common signs of illness in humans.
HB 1.3.2.Students know the precautions they should take to protect their health. It focuses on personal hygiene, seasonal dressing, washing hands before consuming fruits and vegetables, doing sports, protecting from infectious diseases, using rational drugs, and the importance of visiting a dentist and a doctor.	
HB 1.3.3.Students select the food and beverage which is beneficial for their health. Essential animal and plant nutrients are emphasized for balanced nutrition. It emphasizes not to be choosy in eating, and the danger of the consumption of such products as unspecified foods and foods sold in the open and / or on the street and carbonated beverages.	
HB 1.3.4.Students eat in a balanced and proper manner during the day.	
HB 1.3.5.Students prepare food for themselves by paying attention to cleaning rules. It focuses on the food to be prepared without using cutting tools, cookers and ovens. It is reminded that they must wash their hands before they start to eat.	
HB 1.3.6.Students follow the etiquettes while eating. While eating in school it emphasizes to pray before eating, eat properly, not to stand and go around or speak while eating and use napkins. It emphasizes to eat as needed and preventing bread and food wastage.	
HB 1.3.7.Students make healthy choices while using mass media. The importance of consciously using mass media such as television, telephone and computer is emphasized. The points to be considered when mass media are mentioned and the negative effects of misuse of these tools on human health are emphasized.	

How the World Works: Exploring Nature's Cycles	
Conceptual lens: Interconnectedness and Cycles: This lens emphasizes the interconnected nature of natural phenomena and the cyclical patterns that govern them. It encourages students to explore how various elements within Earth's systems interact and influence each other in recurring patterns. By focusing on cycles, students gain insights into the rhythms of nature, such as the seasonal changes, celestial movements, and environmental processes.	
M.O.N.E	Cambridge
HB 1.2.6.Students make daily planning. It focuses on allocated time to playing games, studying, resting, sleeping, eating, spending qualified time with family and friends, and using mass media.	2Ps.01 Know that there are many light sources, including the Sun.
HB 1.6.5.Students know the materials which can be recycled. The materials such as plastics, paper, glass and battery are introduced.	2Ps.02 Know that darkness is the absence of light.
HB 1.6.6.Students observe the Sun, Moon, Earth and stars. It focuses on topics such as the shape of the Sun, Moon, Earth, and the size of the stars.	2Pe.01 Identify how we use electricity and describe how to be safe with it.
HB 1.6.7.Students search seasons and their features.	2Pe.02 Recognise the components of simple circuits (limited to cells, wires and lamps).
HB 1.6.8.Students know the changes in nature in accordance with the seasons. Seasonal changes in the nature and the effects of these changes on plants, animals and humans are emphasized.	2Pe.03 Explore the construction of simple series circuits (limited to cells, wires and lamps).
	2ESs.01 Describe the apparent movement of the Sun during the day.

Where We Are In Place and Time: Understanding myself, My Family, and Others	
Conceptual lens: Identity and Growth: This lens encompasses various aspects related to family dynamics, personal relationships, and self-awareness. It emphasizes understanding similarities and differences with peers, describing the growth and development of offspring, and recognizing the combination of features inherited from parents. Additionally, it focuses on introducing and understanding family members, emphasizing the importance of family values.	
M.O.N.E	Cambridge
HB 1.1.1.Students participate in the classroom meeting activity. The students meet the teacher and friends by introducing themselves.	2Bs.01 Compare how animals, including humans, are similar and different in their external body parts and skin covering.
HB 1.1.2.Students distinguish the similarities and differences between themselves and their peers. It emphasizes the awareness of special needs of students by mentioning the physical characteristics of them and the important to care the devices and prosthesis they use.	2Bp.03 Describe how the offspring of animals, including humans, change as they become older.
HB 1.2.1.Students introduce their family members. Explaining family notion it emphasizes the names and characteristics of members like mother-father, sibling, grandfather and grandmother. It is important to be sensitive while teaching objectives in classes in which children have experiences such as divorce, death, divorce.	2Bp.04 Know that animals, including humans, produce offspring that have a combination of features from their parents.
HB 1.2.2.Students understand the importance of family. It emphasizes the values that keeps family together (love,respesct,loyalty, compassion, fidelity), intrafamilial cooperation, solidarity which contribute to a family life.	
HB 1.5.5.Students know Atatürk's life. The place of birth of Atatürk, the name of his mother and father, the place of his death and the Anıtkabir are introduces by visual and auditory materials.	
HB 1.5.6.Students participate in the events of national holidays. 29 October Republic Day, 23 April National Sovereignty and Children's Day, 19 May Commemoration of Atatürk Youth and Sports Day, and the meaning of these days are emphasized.	
HB 1.5.7 Attends the religious day and feast celebrations willingly. Preparations made at home and in the vicinity during Eid al-Adha and Eid al-Adha; ram and the meaning of the holiday for children. In addition, other religious days It is mentioned.	

Sharing the Planet: Materials and Properties	
Conceptual lens: Forces and Response: This lens focuses on how different forces interact with materials and influence their behavior. It helps us understand how materials respond when forces like pushing, pulling, or gravity act on them. Through this lens, students explore how materials bend, stretch, or stay still when forces are applied to them. They also learn about how materials can be strong or flexible, and how their properties affect how they respond to forces.	
M.O.N.E	Cambridge
HB 1.6.5.Students know the materials which can be recycled. The materials such as plastics, paper, glass and battery are introduced.	2Cm.01 Understand that some materials occur naturally and others are manufactured.
	2Cp.01 Describe a property as a characteristic of a material and understand that materials can have more than one property.
	2Cc.01 Know that some changes can turn a material into a different material.
	2Cp.02 Explain why materials are chosen for specific purposes on the basis of their properties.
	2Cp.03 Know that materials can be tested to determine their properties.
	2Pf.01 Know that forces can change the movement of an object.
	2Pf.02 Know that forces can change the shape of an object.
	2Pf.03 Recognise that things will only speed up, slow down or change direction when something else causes them to do so.
	2Pe.01 Identify how we use electricity and describe how to be safe with it.
	2Pe.02 Recognise the components of simple circuits (limited to cells, wires and lamps).
	2Pe.03 Explore the construction of simple series circuits (limited to cells, wires and lamps).
	2ESp.01 Describe and compare different types of rock.
	2ESp.02 Know rocks are extracted from the Earth in different ways, including from quarries, mines and riverbeds.

DO NOT FIT	
M.O.N.E	Cambridge

Appendix F

Internally and Externally Validated Units Made by Principal Researcher

Step 1: Create the unit title (focus or context)	**How We Organize Ourselves: School Safety and Habitats**	
Step 2: Identify the conceptual lens	**Conceptual lens**: Environments and Relationships: The conceptual lens includes understanding the importance of keeping nature and the environment clean, observing animals and plants in their habitats, recognizing the impact of human activity on the environment, caring for animals and plants in the vicinity, and the school environment.	
Step 3: Unit Strands	The unit strands for our "How We Organize Ourselves: School Safety and Habitats" unit can be:	
	M.o.N.E	Cambridge
Step 4: Unit Topics	HB.1.6.4. Is sensitive about keeping nature and the environment clean. Focuses on what needs to be done to keep nature and the environment clean and warns others within the framework of environmental etiquette.	2Be.02 Know that different habitats contain different plants and animals.
	HB.1.6.1. Observes animals in the vicinity. Focuses on the animals in the vicinity (fish, birds, reptiles, insects, and pets, etc.) and their feeding habits and habitats. Necessary safety precautions are taken if observation is to be made.	2Be.01 Know that an environment in which a plant or animal naturally lives is its habitat.
	HB.1.6.3. Takes care to protect animals and plants in the vicinity.	2Be.03 Identify similarities and differences between local environments in terms of hot, cold, dry, wet, many plants, few plants, many animals and few animals.
	HB.1.6.2. Observes plants in the vicinity. Observes garden plants, wild plants, and trees in the vicinity and how they change over time (plant growth, shedding and blooming of leaves and flowers, etc.). Focuses on these issues based on observations.	2ESp.03 Know that human activity can affect the environment.
	HB. 1.1.1.Students participate in the classroom meeting activity. The students meet the teacher and friends by introducing themselves.	
	HB. 1.1.3.Students obey the safety rules on their way to school. It focuses on the basic rules that must be followed in service vehicles, the use of pedestrian crossings, pavements and roads, and what to consider when communicating with someone they know and do not know	
	HB. 1.1.4.Students find the location of the class in school. Basic concepts about direction; right, left, in front of, behind, under, on, next to, opposite etc. are stressed	
	HB. 1.1.5.Students recognize the educational tools and materials and the honor corner which are located the class.	
	HB.1.1.6.Students know how to act in flag raising ceremony.	
	HB. 1.1.7.Students recognize departments of the school. Students are shown the place of the class in the school. In addition, other departments are introduced by visiting the administrative part, teachers' room, guidance service, canteen, library, gym, toilets and units in school.	
	HB. H.B.1.1.8. Student know how to use toilet and follow the rules related with it. It emphasizes the importance of how to use the toilets (Visiting the toilets, asking for permission, being respectful for own ant other's privacy in the bathroom).	
	HB. 1.1.9. They know the school staff members. School principal, assistant principals, teachers and other service staff.	
	HB. 1.1.10. Students receive help from school staff when it is necessary. The circumstances are explained to the students in which they should seek permission and assistance of Teachers, on-duty teachers, servants and administrative staff.	
	HB. 1.1.11.Students participate in the process of determining in-class rules. It emphasizes the necessity of using the class materials with care, keeping the class clean, paying attention to the timing in communication (listening, talking, speaking on the spot) and not harming the friends and friends' property and keeping the environment clean.	
	HB. 1.1.12.Students obey the rules inside of the school and at the school yard. It focuses on issues such as following stairway up and down rules, not hanging from the window, not touching the cables and plugs, using the school materials carefully and lining up in the classroom, hallway, school garden, dining halls, and while using the trash can.	
	HB.1.1.13.Students follow the courtesy rules while communicating in school. It emphasizes the need to use courtesy statements such as "thank you, hello, good morning, good day, goodbye, please, apologize, please" while communicating with their teacher, friends and school staff. It emphasizes the need for permission while entering someone's room (teacher's room, director's room, servant's room, classroom etc.)	
	HB. 1.1.14.Students take place in-class and in-school activities. It is highlighted that it is important to attend club activities, to participate in school council activities in certain days and weeks. / Okul içi etkinliklerde görev almaya istekli olur. Belirli gün ve haftalara katılma, kulüp faaliyetlerinde bulunma, okul meclisi çalışmalarına katılma vb. konular üzerinde durulur.	
	HB.1.1.15.Students are willing to take place in the games and playing Student is guided to have fun with the game, to comply with the rules of the game, to show appropriate behaviors in the game, to make friendships, to define oneself and others.	
	HB.1.1.16.Students develop positive feelings and ideas about school. It emphasizes the contributions of the school to individual life (making new friends, playing games, having fun, getting information, etc.) and the sensitiveness to students who may have fear of school.	
	HB 1.1.17.Students choose educational tools and materials. The course tools to be used are introduced, focusing on using them correctly, safely and transporting them properly. The use of pens, notebooks and bags is particularly emphasized.	
	HB 1.5.1.Students recognize general characteristics of the place they live in. They are asked to learn about specific characteristics of the names of family elders, the place they live in (neighborhood / village / district / province), the products grown.	

	HB 1.4.7.Students recognize safe and unsafe areas for themselves. It emphasizes the importance of being careful in danger areas such as elevators, stairwells, balconies, basement floors of buildings, construction sites, water channels, pits, water deposits and ornamental pools.	
	HB 1.4.1.Students follow the safety rules at home and in school. It is emphasized that it is important to carefully climb up and down stairs, to get on the elevator, to walk on wet ground, to be careful while using glazed objects (cabinet, corner of honor, etc.) in the classroom, such as power outlets, cables and not to play with fire, not leaving the water tap open, to recognize cleaning materials and to know what to do in case of gas leakage.	
	HB 1.4.2.Students observe traffic rules and behaviours of people in traffic while coming to and from school.	
	HB 1.4.3.Students obey the traffic rules. It focuses on crossing over, walking on crosswalk and on road, takining precautions as a pedestrian. It also focuses on knowing what traffic signs (stop, late, pedestrian crossing, attention, school passage, bicycle can not enter) are and what to do in places where there are no signs (lower and upper passages, pedestrian crossings, school crossings, traffic lights and the places where traffic cops are, keeping the distance from a vehicle, etc.)	
	HB 1.4.5.Students know the telephone numbers of institutions to call to get help in case of emergency. Emphasizing on inconveniency of falsely reporting, emergency numbers of instutitons are introduced (for fire service 110, ambulance 112, police department 155, gendarmerie 156, forest fire 177, and so on.) Telephone numbers are coded in the form of one by one (1-5-5).	

Step 1: Create the unit title (focus or context)	**Who We Are: A Healthy Me**	
Step 2: Identify the conceptual lens	**Conceptual lens**: Health and Well-being This lens encompasses various aspects of personal care, health precautions, nutrition, food preparation, and media usage. It emphasizes understanding the importance of maintaining personal hygiene, following health precautions, making healthy food choices, managing diet, and using media responsibly.	
Step 3: Unit Strands	The unit strands for our "Who We Are: unit can be:	
	M.o.N.E	Cambridge
Step 4: Unit Topics	HB 1.3.1.Students maintain their personal care. It focuses on washing hands and face, teeth brushing, bathing, hairdressing, toilet training, wearing daily clothes. It also emphasizes continuity in personal care. When doing personal care, it is mentioned that resources should be used efficiently.	2Bs.02 Identify the different types of human teeth, explain how they are suited to their functions and describe how to care for teeth.
	HB 1.3.2.Students know the precautions they should take to protect their health. It focuses on personal hygiene, seasonal dressing, washing hands before consuming fruits and vegetables, doing sports, protecting from infectious diseases, using rational drugs, and the importance of visiting a dentist and a doctor.	2Bp.01 Know that humans need to manage diet, maintain hygiene and move regularly to be healthy.
	HB 1.3.3.Students select the food and beverage which is beneficial for their health. Essential animal and plant nutrients are emphasized for balanced nutrition. It emphasizes not to be choosy in eating, and the danger of the consumption of such products as unspecified foods and foods sold in the open and / or on the street and carbonated beverages.	2Bp.02 Describe what illness is and describe the common signs of illness in humans.
	HB 1.3.4.Students eat in a balanced and proper manner during the day.	
	HB 1.3.5.Students prepare food for themselves by paying attention to cleaning rules. It focuses on the food to be prepared without using cutting tools, cookers and ovens. It is reminded that they must wash their hands before they start to eat.	
	HB 1.3.6.Students follow the etiquettes while eating. While eating in school it emphasizes to pray before eating, eat properly, not to stand and go around or speak while eating and use napkins. It emphasizes to eat as needed and preventing bread and food wastage.	
	HB 1.3.7.Students make healthy choices while using mass media. The importance of consciously using mass media such as television, telephone and computer is emphasized. The points to be considered when mass media are mentioned and the negative effects of misuse of these tools on human health are emphasized.	
	HB 1.2.7.Students distinguish the differences between wantings and needs.	
	HB 1.2.5.Students use the sources efficiently and properly at home. It mentions the proper use of electricity, water and personal hygiene materials.	
	HB 1.5.7 Attends the religious day and feast celebrations willingly. Preparations made at home and in the vicinity during Eid al-Adha and Eid al-Adha; ram and the meaning of the holiday for children. In addition, other religious days it is mentioned.	

Step 1: Create the unit title (focus or context)	**Where We Are In Place and Time: Understanding Myself, My Family, and Others**	
Step 2: Identify the conceptual lens	**Conceptual lens**: Identity and Growth: This lens encompasses various aspects related to family dynamics, personal relationships, and self-awareness. It emphasizes understanding similarities and differences with peers, describing the growth and development of offspring, and recognizing the combination of features inherited from parents. Additionally, it focuses on introducing and understanding family members, emphasizing the importance of family values.	
Step 3: Unit Strands	The unit strands for our "Where We Are in Place and Time: Understanding Myself, Myself, and Others" unit can be:	
	M.o.N.E	Cambridge
Step 4: Unit Topics	HB.1.1.2. Distinguish the similarities and differences between himself and his peers.	2Bp.03 Describe how the offspring of animals, including humans, change as they become older.
	HB 1.2.1.Students introduce their family members. Explaining family notion it emphasizes the names and characteristics of members like mother-father, sibling, grandfather and grandmother. It is important to be sensitive while teaching objectives in classes in which children have experiences such as divorce, death, divorce.	2Bp.04 Know that animals, including humans, produce offspring that have a combination of features from their parents.
	HB 1.2.2.Students understand the importance of family. It emphasizes the values that keeps family together (love,respesct,loyalty, compassion, fidelity), intrafamilial cooperation, solidarity which contribute to a family life.	
	HB 1.2.3.Students give direction of their houses. It deals with what is next to, in front of, in the face of, behind, on its right and on its left of the house. It is emphasized that the home address of the student and the telephone number of at least one of the family members should be kept in writing and that who is reliable to share this information. In the learning process, drawing a sketch of the environment may be dramatised.	
	HB 1.2.4.Students follow courtesy rules when communicating with family members at home. When communicating with family members at home, it emphasizes using a appropriate tone of voice, mimicry and words on the basis of courtesy rules when they deliver their requests and needs, express their feelings, thoughts and wishes. It is emphasized that when entering the room of the other members of the house, permission is required.	
	HB 1.2.5.Students use the sources efficiently and properly at home. It mentions the proper use of electricity, water and personal hygiene materials.	
	HB 1.2.6.Students make daily planning. It focuses on allocated time to playing games, studying, resting, sleeping, eating, spending qualified time with family and friends, and using mass media.	
	HB 1.5.4.Students realize that they live together with people from different cultures in our country. It introduces people who have emigrated from their countries, either compulsory or voluntarily.	
	HB 1.5.2.Students are acquainted with historical and touristic places in which they live.	
	HB 1.4.4.Students know how to act to strangers or familiar people around. It emphasizes to reject any offer or intitation that violate their personal right while communicating.	
	HB1.5.3.Students recognize the general characteristics of our country. The name of our country, its capital, the National Anthem and the Turkish flag are introduced. The color of the flag is indicated by emphasizing the moon and star.	

Step 1: Create the unit title (focus or context)	**How the World Works: Exploring Cycles**	
Step 2: Identify the conceptual lens	**Conceptual lens**: Interconnectedness and Cycles: This lens emphasizes the interconnected nature of natural phenomena and the cyclical patterns that govern them. It encourages students to explore how various elements within Earth's systems interact and influence each other in recurring patterns. By focusing on cycles, students gain insights into the rhythms of nature, such as the seasonal changes, celestial movements, and environmental processes.	
Step 3: Unit Strands	The unit strands for our "How the World Works: " unit can be:	
	M.o.N.E	Cambridge
Step 4: Unit Topics	HB.1.6.6. Observes the Sun, Moon, Earth, and stars. Focuses on topics such as the shape and size of the Sun, Moon, Earth, and stars.	2ESs.01 Describe the apparent movement of the Sun during the day.
	HB.1.6.7. Investigates the seasons and their characteristics.	2Ps.01 Know that there are many light sources, including the Sun.
	HB.1.6.8. Understands the changes that occur in nature according to the seasons. Focuses on the changes in nature according to the seasons and their effects on plants, animals, and humans.	2Ps.02 Know that darkness is the absence of light.
		2Pe.01 Identify how we use electricity and describe how to be safe with it.
		2Pe.02 Recognise the components of simple circuits (limited to cells, wires and lamps).
		2Pe.03 Explore the construction of simple series circuits (limited to cells, wires and lamps).

Step 1: Create the unit title (focus or context)	**Sharing the Planet: Materials and Properties**	
Step 2: Identify the conceptual lens	**Conceptual lens**: Forces and Response: This lens focuses on how different forces interact with materials and influence their behavior. It helps us understand how materials respond when forces like pushing, pulling, or gravity act on them. Through this lens, students explore how materials bend, stretch, or stay still when forces are applied to them. They also learn about how materials can be strong or flexible, and how their properties affect how they respond to forces.	
Step 3: Unit Strands	The unit strands for our "Sharing the Planet: " unit can be:	
	M.o.N.E	Cambridge
Step 4: Unit Topics	HB.1.6.5. Differentiates materials that can be recycled. Focuses on materials such as plastic, paper, batteries, vegetable oil, and glass.	2Cc.01 Know that some changes can turn a material into a different material.
		2Cp.01 Describe a property as a characteristic of a material and understand that materials can have more than one property.
		2Cp.02 Explain why materials are chosen for specific purposes on the basis of their properties.
		2Cp.03 Know that materials can be tested to determine their properties.
		2Cm.01 Understand that some materials occur naturally and others are manufactured.
		2Pf.01 Know that forces can change the movement of an object.
		2Pf.02 Know that forces can change the shape of an object.
		2Pf.03 Recognise that things will only speed up, slow down or change direction when something else causes them to do so.
		2ESp.01 Describe and compare different types of rock.
		2ESp.02 Know rocks are extracted from the Earth in different ways, including from quarries, mines and riverbeds.