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Early Childhood Education

Innovative Pedagogical Approaches in the Post-Modern Era

Edited by Maria Ampartzaki and Michail Kalogiannakis

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Published in London, United Kingdom

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http://dx.doi.org/10.5772/intechopen.98078
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First published in London, United Kingdom, 2023 by IntechOpen
IntechOpen is the global imprint of INTECHOPEN LIMITED, registered in England and Wales, registration number: 11086078, 5 Princes Gate Court, London, SW7 2QJ, United Kingdom

British Library Cataloguing-in-Publication Data
A catalogue record for this book is available from the British Library

Additional hard and PDF copies can be obtained from orders@intechopen.com

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Edited by Maria Ampartzaki and Michail Kalogiannakis
p. cm.
Print ISBN 978-1-80355-948-3
Online ISBN 978-1-80355-949-0
eBook (PDF) ISBN 978-1-80355-950-6

Meet the editors

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Preface

Contemporary Challenges in Early Childhood Education

The importance of education and care in the early stages of life has long been debated and documented. However, in a world that faces ongoing crises and challenges, early childhood education is in a constant quest for pedagogies that respond to acute problems such as:

- Environmental crises that result in food and water shortages
- The growth of digital environments that can educate and empower as well as exploit and destroy (mobile learning, STEM education, tablets, etc.)
- Social, racial, class, and gender-based discriminations that restrict developmental potential and prosperity perspectives
- Health hazards and illnesses such as the latest COVID-19 pandemic
- Armed conflicts with casualties and displacements of populations seeking refuge
- Lack of physical spaces that support and nourish development and learning

These are only some of the challenges and conditions that shape children's lives in today's world. Children's experiences and development are defined by gender, social and economic status, and the geographical position in which they grow up [1–5]. Education in the post-modern perspective strives to address the aforementioned issues and develop policies, curricula, methodologies, and strategies to contribute to an environmentally and socially sustainable future. It embraces multiple perspectives and worldviews and seeks to touch on inequalities and discrimination in favour of equity [6, 7].

Educators, pedagogues, and carers need to work toward the reformation of oppressive situations and use progressive ideas to increase the effectiveness of their efforts. Everyday concepts and understandings are re-examined for embodied prejudices and oppressive perceptions in education. Educators, pedagogues, and carers need now to justify the choices they make and the ethical and political values they promote [6]. The challenge for education is how curricula, policies, and programs (which are highly homogenized and formed under the influence of the so-called developed countries) can address a heterogeneous population (of children and families) with different, alien, and incommensurable issues, experiences, values, and perceptions. This multiplicity should not become an obstacle but rather a starting point for emancipatory actions and processes [4].

Moreover, multi-agency, holistic, and integrated approaches seem to be the key to successful and effective interventions that address each problem in a systemic approach and not as a standalone issue [8–10]. In this direction, children's agency lies at the heart of democratic approaches [7, 11]. Educational processes adopt forms of interactions that actualize learning as "becoming" and place it in a continuum between past, present, and future [12, 13].

This book features innovative approaches that employ transformative elements (targets, methods, materials, ideas, etc.) and embrace the concept of child development as "becoming" in an ever-changing and challenging world.

Thus, in Chapter 1, "Caring about Early Childhood Education", the author argues against the care-education dichotomy in the early childhood sector. In the comparison between the two, care is conceptualized as something less important than education. The author embraces and advocates the materialization of "edu-care," which is a concept that signifies the inseparability of care and education for the young child. This conceptualization is congruent with the conception of integrated approaches and strategies for the benefit of the child.

Chapter 2, "Next-Generation Science and Engineering Teaching Practices in a Preschool Classroom", focuses on the teaching and learning practices emerging in the framework of science and engineering lessons organized into early childhood settings. Analyzing learning interactions at the micro level of the classroom is important because it allows a deeper understanding of the enacted in comparison to the envisioned teaching practices. Increasing quality and meaningful STEM learning experiences that cover the full range of standards and learning practices satisfy one of the basic conditions of equitable learning environments, that is, to meet the demands of all students and help them maximize their potential. The outcomes presented in this chapter are in agreement with the outcomes of comparative survey research regarding perceptions and practices of the STEAM approach the readers can find in the following chapter.

In Chapter 3, "STEAM Implementation in Preschool and Primary School Education: Experiences from Six Countries", the authors present the results of a survey carried out in six countries: Turkey, Romania, Greece, Bulgaria, Poland, and Lithuania. This survey focused on how preschool and primary teachers, preschool student teachers, parents, STEM professionals, and artists perceive the STEAM approach and the integration of art into the teaching of STEM subjects. Although teachers, parents, and STEAM professionals did not feel they had detailed knowledge about the STEAM approach, they showed positive attitudes toward the idea of integrated teaching and learning. The survey sample showed concern about the increase in learner differences and was keen to welcome art contributions toward more holistic ways of learning. Gender discrimination was also discussed with the survey participants as well as the issues faced by the disadvantaged students. The study concludes that the way forward demands a systemic approach that will support equitable STEAM learning, progress, and equity in STEM careers.

Chapter 4, "Local History in a Digital Environment: Creating an Online Course for Young Children", puts forward a relatively new approach to the post-modern view

of history teaching and learning. The authors present an online course, which aims not only to introduce young children to learning local history through inquiry but also to use the digital environment as a learning space. Thus, the effort is two-fold: at one level, history learning is based on open-ended and flexible tasks that empower children by promoting their agency, and at the other level, the instructional technology is set up and customized to provide constructivist and "transformative" learning experiences to children.

Finally, Chapter 5, "Postmodernist Ideas and Their Translation into a Critical Pedagogy for Young Children", stresses the need for post-modern ideas and values to shape early childhood pedagogy. The post-modern paradigm is directed more toward social interactions and the way they can transform human life to equitable prosperity. According to this, critical pedagogy is a basic component of the curriculum and focuses on the development of awareness of social issues and the needs of others, responsiveness to social issues, the development of social responsibility, and advocacy for social justice. As the author of the chapter concludes, "throughout the world, parents, ECEC professionals and governments need to be persuaded that a transformation of how young children are educated to become global citizens should be a priority."

This book offers some thought-provoking readings that could prompt wider discussions on the critical role that early childhood education is called to play in the post-modern era. We would like to thank all the authors for their contributions and their collaboration throughout the review process.

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Chapter 1

Caring about Early Childhood Education

Dawn Murphy

Abstract

Early Childhood Education (ECE) is a broad term encompassing the care and education of children in the years before the commencement of primary school education. The purpose of ECE as the beginning of children's educational journey versus childcare for working parents is widely contested, contributing to a care and education dichotomy within the sector. Education and care are inseparable constructs and particularly so within the early years. Attempts to distinguish between early years care and education support the establishment of a skills hierarchy where care is regarded less favorably than education. This chapter discusses 'edu-care' as an alternative way of understanding ECE whereby education and care are recognized as inseparable and equally valued. As the professionalization of ECE continues to gain momentum, this process must take a holistic conceptualization of ECE within which 'edu-care' is fundamental. Regulation, increased levels of qualification for early childhood educators and quality provision dominate the discourse of ECE professionalization. However, this narrow emphasis on performativity must not overshadow the immeasurable but essential components of ECE, that of care and love.

Keywords: pre-school, Edu-care, gender issues, professionalization, performativity, schoolification

1. Introduction

Early Childhood Education (ECE) exists in a complex and messy trajectory which serves to make its purpose conflicted. Increased global economic growth, a return of mothers to the workforce and international recognition of the value of ECE in the furthering of human capital [1] have combined to position ECE to the forefront of the policy agenda. However, the policy emphasis for ECE has largely envisaged the sector as facilitating working parents (specifically mothers) and developing human capital. This conceptualization of ECE has been detrimental to the development of policy that prioritizes education for human flourishing [2]. Caution exists around the increased 'schoolification' of ECE [3]. However, despite the inextricable relationship between love, care and education in early childhood, a reluctance exists to embrace love and care arising from concerns that this will undermine the professionalization of the sector [4]. This chapter problematizes what is valued in ECE questioning the rationale for this and arguing for the adoption

of 'educare' [5] which would provide a holistic understanding of the purpose of ECE, encompassing and equally valuing care and education.

2. Competing discourses in early childhood education

The existence of a distinction between care and education within ECE is consistently documented [6, 7]. While the limitations of this artificial distinction are identified [8] this division of the two persists. Initially economically driven, the development of ECE focused on providing care for children during their early years. While education, in addition to care, was undoubtedly provided to children within these settings, the primary function was care provision that corresponded to the needs of working parents – the needs of the child were arguably secondary [9]. Within this context, it is unsurprising that those employed in ECE, were largely regarded as substitute mothers. Accordingly, a need for training and education to perform this role was not recognized, rather it was regarded as intuitive for women [7].

2.1 The persistence of a care and education divide

The prevalence of a distinction between care and education is an international phenomenon. The positioning of much early childhood provision in the care category is unhelpful for early childhood educators and the sector in general. Provision for children from birth to 3 years is typically understood to be childcare while provision for children from three to 6 years is more commonly identified as education. Among 30 OECD countries, the existence of an education and care divide is so entrenched structural distinctions with 'divided government responsibilities' for care and education exist [7]. Among the Nordic countries, where care and education are not artificially separated, the qualification and pay scales of early childhood educators are aligned to that of primary and secondary teachers [7]. However, where distinctions between early years care and education exist, lower levels of qualification and renumeration are deemed acceptable within the provision identified as care [8].

The conflict appears to exist at the policy level as to the long-term goals for the development of ECE. The value of educators with increased levels of qualification is recognized for optimizing, 'healthy child development' [10]. However, there is also a realization that higher qualified educators will expect increased rates of renumeration. Accordingly, caution is urged around the proportion of graduates required to work in the sector [10]. Consequently, the solution has increasingly been adopted appears to be the creation of a 'graduate led workforce'. Such an approach appears to satisfy the requirement for educators with higher levels of qualification, whilst limiting associated renumeration costs. Aside from the divisive nature of this employment strategy, it further reinforces the care and education divide in the sector. Responsibility for leading educational activities within a room is directed toward graduates while care responsibilities are delegated to educators with lower levels of qualification. This devaluing of care relegates it to a 'lower order skill' which is 'taken for granted' despite providing the foundation for the 'higher skills of professionalism' to be laid ([11], p. 87). This creation of a two-tier workforce effectively ensures the continued separation of care and education within ECE, with education positioned as both removed from and superior to care.

In considering ECE, there is an understanding that 'effective learning environments are nurturing. Caring is educational; education is caring and both are effective when responsive to the child' ([6], p. 7). Similarly, teaching is recognized as a 'caring profession and care work is endemic to education'. However, within a neo-liberal agenda, the importance of caring, 'has been increasingly eroded' with the emphasis shifting to regulation and a narrow and rationalistic notion of a duty of care ([12], p. 84). Societal and political contradictions between ECE are extensive. This persistent distinction between early childhood educators and primary school teachers reinforces the care and education divide and represents an inequitable valuing of care versus education [13].

2.2 The pursuit of quality

During the last 20 years, the role of ECE has increasingly been recognized as important in supporting the development of human capital [1]. Enhanced child development, increased rates of school completion, reduced incidence of unemployment and incarceration are all identified as positive outcomes resulting from quality experiences of early childhood education [14]. However, the existence of quality provision is consistently identified as essential in the achievement of the maximum outcomes of ECE. Despite the frequency with which quality is referred to both in policy documents and in the public domain, quality is a contextual concept that may benefit from questioning and problematizing [15]. Furthermore, distinctions exist between 'a good service' and a 'quality' service. The notion of a 'quality service' is 'value laden, reflective of an economic agenda rather than the perspective, knowledge and experiences of ECE professionals, or children and their families' ([1], p. 7). This political value attributed to the achievement of 'quality' provision also serves to legitimize the increased surveillance of ECEC services with the justification of monitoring the governments, 'human capital' investment [1]. This rationale for monitoring and striving for quality is difficult to contest [16]. Challenges to such inspection may spark concern that questionable practice exists within a setting which within market models of ECE, is an aspiration all settings will be keen to avoid. Essentially, the prevalent policy discourse of quality provision within ECE translates to a deficit model of the sector [17] where without regulation and the omnipresent fear of inspection [18] settings could not be trusted to achieve such high standards.

At the policy level, there appears to be a merging of the discourse of both professionalization and quality [19] with the achievement of increased levels of qualification among early childhood educators recognized as fundamental to this professionalization process. Each discourse within ECE has its own unique conceptualization of the child, the 'most appropriate form of provision' and the type training required for those working in the sector [20]. There has been a shift in emphasis in the purpose of ECE, moving from providing childcare for working parents to supporting children's development with the intended enhancement of their academic achievement, equating to increased human capital. Accordingly, concern has increased regarding the ability of those working in the sector to support children's optimal development. Within ECE, multiple identities exist for early childhood educators. The substitute mother, requires no specific qualification, the technician, is capable of implementing prescribed regulations and standards and finally the researcher, ever reflective upon their daily work with children and working to improve upon it [7]. Internationally, third-level qualifications have increasingly been sought for room leaders and more senior positions within early childhood settings, with subsequent distinctions in job titles and roles according to qualification level [21].

2.3 The schoolification of early childhood education

In alignment with this new appreciation for the value of ECE, increased regulation and accreditation have been introduced to the sector. The intention of standardizing children's early years experiences has largely been to maximize their development during this period [22]. This policy commitment to optimizing children's development initially appears quite admirable. However, concern exists around the increased 'schoolification' of ECE [3] where the introduction of pre-determined learning outcomes for pre-school children, inspection and regulation within the sector is consistently intensifying. Acknowledging the introduction and expansion of the OECD Starting Strong Teaching and Learning International Survey (TALIS) concern about increased performativity demands within ECE appears justified. Gathering international data around the provision of ECE, TALIS aims to undertake international performance comparisons [23] essentially the introduction of Programme for International Student Assessment (PISA) to ECE. PISA has, 'become one of the OECD's most successful products' which has served to legitimize the role of the organization in education within a now global context ([24], p. 917). From the initial conception of TALIS, additional countries have continued to join indicating the growing momentum of this performance tool.

The introduction of TALIS also comes within the context of the former launch of the International Early Learning and Child Well-Being Study (IELS) again organized by the OECD and initially involving just three countries: England, Estonia and the USA [25]. The introduction of IELS, and arguably TALIS, fits within a 'global web of measurement' driven by the OECD. This reductionist perception, limits education to, 'a purely technical exercise of producing common outcomes measured by common indicators' with the OECD acting as, 'the global arbiter, assessor and governor of education' ([26], p. 207). An apparent international desire to create a 'functional datafication of early year's pedagogy' ([27], p. 302) provides a limited and narrow conceptualization of ECE. This position fails to recognize the multiple important layers within ECE that may be neither measurable nor easily observed, specifically care. One explanation of the current performative emphasis on early childhood education may be:

> *Quantification is seductive, because it organizes and simplifies knowledge. It offers numerical information that allows for easy comparison. But that simplification may lead to distortion, since making things comparable often means they are stripped of their context, history and meaning. ([28], p. 24)*

The current emphasis on 'inspection and surveillance' has been prompted by a narrow conceptualization of early years assessment. A prioritizing of numeracy and literacy has resulted in the 'intensification of school readiness pressure' within ECE. With the policy for ECE taking an increasingly consistent 'raising standards' strategy, the pedagogy of early year's educators is becoming focused on children's achievement of pre-determined and standardized learning outcomes. Concerningly, this 'schoolification' of ECE is recognized as been contrary to child-centred values of early years educators [27]. As the discourses of quality and professionalization increasingly merge [19] there is a simultaneous conceptualization of quality as measurable performance at the policy level. Accordingly, early childhood educators are faced with accepting and implementing the performative demands of policy or resist and risk been labeled unprofessional and poor quality – a choice with no real option available.

3. The need for care (and love) within early childhood education

More than 20 years ago, there was recognition that 'caring has become a buzzword in education'. Within this context, care was understood to encompass 'gentle smiles and warm hugs', whilst entirely ignoring the 'complexity and intellectual challenge of the work'. This limited conceptualization of caring was recognized as detrimental to the development of ECE. As an alternative, the adoption of an 'ethic of care' as an approach for understanding the true scope of care within ECE was advocated. Caring has historically been recognized as fundamental to the education of young children but this understanding of care as a personal attribute fails to recognize caring as an intentional and intellectual action. Limiting conceptualizations of caring to personal characteristics supports the 'hegemony of nice' suggests Swadener, a perception that undermines the knowledge and professionalism of early childhood educators when compared to teachers in primary and secondary school settings. Such limited understandings of care were also identified as resulting in poorer pay, status and visibility of those working within the sector [29].

3.1 Conceptualizations of care

Rather than personal characteristic care may be conceptualized as a relation, potentially present in every interaction [30]. Almost in direct opposition to the rigor of evidence-based practice, regulation and standardization, caring encounters are, 'variable, situated and unique' ([29], p. 246). Care is a 'human affective response' within which there is an interaction between the 'one caring' and the 'cared for' [30]. Within this ethic of care approach, no regulations dictating the response of the educator to a child, rather the particular interaction guides and determines the educator's 'right' response [11]. As an alternative to performative professionalism, focused on, 'universal competence, standards and codes of practice' professionalism may be founded on an ethic of care ([11], p. 88) within which love may be recognized as an important quality [31].

An online search of dictionary definitions of care reveals consistent references to both love and concern [32]. Despite this generic understanding of care, references to love between educators and children is frowned upon, fueled by fear this could be considered inappropriate and in addition unprofessional. Within ECE competing discourses of care and education, love is 'unspoken, undefined and taken for granted'. However, far from been unsavory, love is both personal and professional and represents the 'feelings and strong emotional connection' between children and early childhood educators [4] echoing Nodding's understanding of an ethic of care. However, despite its importance to ECE, similar to care, a discourse of love is problematic to the sector with its connotations of nurturing and motherhood, both of which strengthen societal perceptions of women as 'natural carers' thereby negating the need for specific training, knowledge and recognition [7, 33]. In addition, the unseen ways of knowing of love and care have little place within the neo-liberal agenda within which, performativity, standardization and narrow conceptualizations of managerial professionalism are so highly prized [4]. Given the current emphasis on the global race for academic success now recognized as starting within ECE [1] it is interesting that such little attention is afforded to the importance of love in supporting children in achieving this success. Early childhood educators express love in their discussions of the children they work with [34] and parents want educators to show their children love [35]. However, love remains unspoken within the policy discourse, a reality that may

be largely attributable to the immeasurability of love and its subsequent disconnect with the neo-liberal discourse [33].

3.2 Space for love and care within the policy discourse

The pervasive effects of neo-liberalism are evident within society today, with ECE been no exception. The mark of neo-liberalism in policy for ECE may be recognized through a discourse of accountability, standardization, regulation and school readiness [22, 36]. While early childhood educators escaped the 'terrors of performativity' [37] for longer than their colleagues in primary and secondary education, they too are now subject to demands for, 'accountability, attainment targets a compulsory early years curriculum, and standardized approaches to their practice' ([36], p. 188). With increased policy emphasis on performativity, and associated funding implications, early childhood educators have had little choice but to prioritize this regime to their detriment of caring approaches.

Love and care are recognized as fundamental to ECE by the educators within the sector, with consistent references to these concepts during educator's conversations [34]. However, despite this fundamental presence of love within ECE settings, it is largely, 'invisible, transparent, something that has been taken for granted and deemed unworthy of scholarly attention' ([31], p. 258). This silencing of love within the discourse of ECE reflects the current prevalence of scientific rationalism within society [34]. As evidence-based practice and scientific knowledge gained increased currency, the intuitive knowledge valued by Froebel, Pestalozzi and Montessori retained less credibility. Understanding and supporting early childhood has increasingly been explained in scientific terms, with ever increasing importance been placed on child development, psychology and behaviorism. A new scientific discourse of care, behaviorist in its foundations, was been promoted, within which there was no space for emotional care. This current conceptualization of care is 'emotionally detached, favoring the seen over the unseen' ([33], p. 160). However, the detrimental effects of this scientific rational approach to care on children's development are being increasingly recognized by neuroscience and accordingly references to emotional care are remerging with the policy discourse [33]. It is somewhat ironic that care and love were initially silenced by science and the current movement to legitimize the two is now been driven by science!

The language used to describe ECE appears to be in an almost constant state of change. In Norway, largely regarded as the leaders in ECE, a move appears to exist to remove 'care' from the policy discourse with the recent introduction of the, 'National Framework for Early Childhood Teacher Education' [38]. Within an Australian context, the familiar use of term Early Childhood Education and Care (ECEC) positions care in a secondary position to that of education [32]. Within a neoliberal discourse that, 'encourages competition' and 'values measurement in education' love and care has effectively been silenced ([32], p. 160). The discourse of learning, currently popular within ECE, makes frequent reference to, 'pre-defined standards and individualised learning goals' with which comes a danger that children's instinctive learning, achieved through, 'play, freedom of movement, relations and discussions with other children' will be afforded less time ([39], p. 528).

An analysis of a United Kingdom policy document, detailing the requirements for early childhood educators to achieve professional status, of the 39 standards specified, neither 'care' or 'caring' are mentioned once [11]. Interestingly, the introduction to these standards makes several references to care and the need for its provision but

always within the context of 'more than' care been necessary. The additional requirements are then explained within the standards. This framing of care as important but inadequate, effectively creates a 'hierarchy of skills, attitudes and behaviours' resulting in care been ranked less favorably than education ([11], p. 87). Within such deficit conceptualizations of care, its presence is assumed and regarded as a starting point on which to build more professional and measurable standards. Similarly, within an Australian context, a discourse analysis of the Early Years Learning Framework found 220 references to 'learning', nine references to care, caring and nurturing with no explicit reference to love [32]. Within the policy discourse, the emphasis on measurability further compounds the challenge to make space for love. 'Love is difficult to define, impossible to measure, and outside the boundaries of generalizability, reliability and validity. It is fuzzy, subjective, personal, loaded' ([31], p. 258) this does not however make it any less important.

The concept of 'love within the context of early childhood education and care are poorly understood' ([35], p. 313). When asked about priorities in ECE settings, parents consistently expressed a desire for their children to be loved by the educators working with them. While love was not always explicitly name, the behavior parents referred to as desired in early childhood educators aligned with conceptualizations of love, specifically 'professional love'. 'Professional love' may be understood as the loving relationships that are established between educators and children in the context of an early childhood setting [35]. Similarly, early childhood educators themselves place considerable value on love between children and themselves [40].

4. Connecting professionalization, care and love

The role of an early childhood educator is complex with the knowledge and skills required to work in the sector often difficult to quantify and at times overlapping with parenting [7]. Furthermore, and arguably consequently, early childhood educators have traditionally devalued their own 'professional identity [41]. A connectedness exists between love, care and maternalism which has resulted in some conflict as the ECE sector strives for professional recognition [33]. During the 1950's, John Bowlby recognized the centrality of secure attachments for young children's well being [42]. Similarly, Dr Maria Montessori recognized love as a characteristic of early childhood educators. More recently, Noddings and Gilligan's work on an 'ethic of care' has again recognized the fundamental importance of love, care and relationships among those working in ECE [33]. However, conceptualizations of love and care within ECE are conflicted. While love and touch are recognized as essential within ECE for children's development and well-being, they are equally recognized as a potential child protection issue, thus placing early childhood educators in an impossible situation where uncertainty exists as to the appropriateness of love and care between children and educators [42].

4.1 Professionalization and early childhood education

Professionalism is, 'presented as an apolitical and common-sense construct' despite its inseparability from the political, cultural and historical construct it occurs within ([16], p. 5). Conceptualizations of professionalization differ with the increasing popularity of a discourse of 'organizational professionalization'. With this movement from traditional or 'occupational' professionalism to organizational

professionalism, the values of, 'partnership, collegiality, discretion and trust' have been replaced by, 'increasing levels of managerialism, bureaucracy, standardization, assessment and performance review' ([43], p. 407). The presence of organizational professionalism is evident in ECE as educators are increasingly subjected to Foucault's conceptualization of surveillance/inspection and direction [18]. This discourse of organizational professionalism affords little consideration to the immeasurable and intangible concepts of love and care. Minority cases of poor practice within ECE have arguably been disproportionately emphasized to establish and normalize a 'deficit discourse which positions early childhood educators as failing' ([17], p. 741). This discrediting of early childhood educators effectively undermines the values they hold in high regard. Consequently, the dominant policy discourse can become firmly established without contestation. With public confidence in the sector shaken, reassurance around quality and standardization are widely welcomed by parents. With care and love difficult to quantify and standardize, it is not surprising they are afforded little attention in the emerging discourse of early childhood professionalization.

With less than 1% of early childhood educators been male [10] the highly gendered nature of ECE may be recognized as further complicating early childhood professionalization. Historically, medicine and law, both male-dominated sectors, have been recognized as professions. However, caring professions, including teaching, nursing, social work and more recently ECE, all typically female professions demand alternative understandings of professionalism [44]. Typically, a grasp of specific and complex knowledge is a feature of professionalism. However, given the nature of ECE and its association with mothering, within which love and care are fundamental, the identification of a specific body of knowledge presents more of a challenge. Arguably then, an alternative understanding of professionalism is necessary for ECE, within which love and care are recognized and valued.

Within ECE as in other 'contemporary service occupations' professionalism may be understood as 'being imposed from above', resulting in an alternative conceptualization of professionalization being introduced than educators had envisaged [43]. 'Neo-liberal policies erode the professional identify of ECEC teachers by adopting a paradoxical approach in order to involve them in an active process of self-monitoring that leads them to new forms of self-exploitation' ([45], p. 810). With its connotations of increased rewards, recognition and status a professionalism discourse is typically embraced by early childhood educators with a dismissal of love and care largely been accepted by educators as necessary for the achievement of professionalization [16]. However, the reality of organization professionalization is the retention and increasing control by organizational managers and supervisors [43]. Early childhood educators enjoy none of the benefits they envisaged professionalization would bring while additional demands continue to be imposed upon them.

5. Alternative possibilities

A case exists for the adoption of 'educare' for ECE, within which education and care are recognized as equally important for 'curriculum development and pedagogy' within the early years [6]. In its broadest sense, 'educare' recognizes 'the mind and body are inseparable entities' ([46], p. 5). 'Educare' already established within Scandinavian pedagogy for ECE, has the potential to, elevate the status of care and extend conceptualizations of professional roles within ECE. 'Educare' presents an educational philosophy grounded in care with this binding of education and care

attributing an educational value to care [5]. This acceptance of and furthermore the need for the inseparability of care and education within the early years creates a more holistic conceptualization of ECE which extends beyond the measurability of standardized learning outcomes.

Despite the establishment of a care and education divide within several OECD countries, 'Educare' offers an alternative to this artificial division. The increased schoolification of ECE has resulted in the erosion of holistic conceptulisations of education in favor of technical rational approaches. This lack of regard for 'care' in ECE is also evident in the education of future early childhood educators with emphasis placed on supporting children's academic learning [46]. Within a discourse of science and 'evidence based' practice, an element of disdain for care and caring may be recognized [29]. Educare supports a conceptualization of ECE within which educators need not feel compelled to sacrifice caring responsibilities to achieve professional recognition. With its potential to 'elevate the status of care and take it seriously' Educare provides a way to 'transform professional roles within education' [5]. Essentially, educare recognizes care as fundamental rather than secondary to education. Within this model, learning is understood in terms of the social, emotional and cognitive rather than been limited to academic achievement [5]. Furthermore, this inextricable linking of education and care, recognizes the educational value of care rather than reducing it to a secondary consideration.

Within the neo-liberal agenda, education is increasingly regarded as 'just another service to be delivered on the market' with little value of this provision as a public good. The very nature of caring makes it difficult to measure and even to attempt to do so is contradictory to the concept. As the emphasis of education, including that of ECE, has become increasingly regulatory and controlling so caring responsibilities have become diminished [12]. It would appear the time for the adopting a holistic view of ECE, one of which encompasses broad understandings of care, has never been more necessary.

As the professionalization of ECE intensifies, consideration of alternative understandings of professionalization are important. While the prevalence of inspection and standardization within ECE may align with understandings of organizational professionalism, occupational or democratic professionalism offers an alternative. Democratic professionalism allows for 'collaborative, cooperative action between teachers and other educational stakeholders' [47]. Essentially, it represents a move away from the traditional top-down approach of policy makers and moves toward a 'ground up' [48] strategy allowing for the challenging of, 'the hegemony of expertise and dominant knowledge' as dialog between early childhood educators and policy makers 'bridges the gap between ways of being and ways of knowing'. ([19], p. 147). True dialog between early childhood educators and policy makers within which early childhood educators believe their knowledge and perspective is valued has the potential to reposition care as an integral part of ECE.

6. Conclusion

Care is a complex concept that extends beyond a physical act. However, care is contextual and, 'caring performances are dictated and often restrained by social and political norms and practices' ([46], p. 6). Critically, professionalization and care are not mutually exclusive. The dominant policy discourse around ECE professionalization has adopted an 'organizational' model of professionalization and it is within this

specification the incompatibility with care exists. As the place of ECE continues to become more firmly established as part of education, so too the professionalization of the sector is recognized as part of this process. Therefore, the model of professionalization adopted for ECE must be 'fit for purpose'. The application of traditional or organizational models of professionalization are not appropriate for ECE. Standards and inspection undeniably have a place within ECE and of course a body of knowledge is necessary for early childhood educators. However, within ECE and arguably life in general, it is not only that which is measurable that is important. The performative demands of organization professionalization must not be allowed to overshadow caring responsibilities within ECE. 'Caring is only visible when not it is not done' ([13], p. 89) and consequently, it is assumed rather than made explicit in the policy discourse. This invisibility of care results in its societal devaluing and contributes to early childhood educators questioning care as a value they intrinsically hold.

Rather than a battle of supremacy between care and education, the adoption of 'edu-care' within a discourse of democratic professionalization for ECE offers a way forward. Recognition of the inseparability of early years care and education acknowledges the fundamental need for care within ECE. Rather than seemingly undermining professionalization, the place is reserved for care within democratic conceptualizations. Similarly, the requirement for standards and inspection of services has space within a democratic model of professionalization. The recognition of educator autonomy and knowledge within democratic professionalism negates the need to reduce every aspect of ECE to that which can be measured. It is somewhat contradictory that as levels of qualification among early childhood educators have increased, there has been a corresponding intensification of regulation and inspection within the sector, a development sadly reflective of organizational professionalization.

Care or 'human flourishing' [2] is a fundamental element of all education but especially where the age of those been educated is so young. Contrary to the academic and performative emphasis of the current ECE discourse, care within education must be valued and encouraged and to do so must not be understood as detrimental to the professionalization process. ECE is emerging as a new profession and as such it is essential that the values of care and love, highly prized by educators, parents and children, are validated rather than sacrificed by the professionalization process. Early childhood is consistently recognized as a critical period in children's lives. Accordingly, it is essential young children enjoy an education shaped by care for their holistic development to be truly supported.

Acknowledgements

I would like to thank Dr. Geraldine Mooney Simmie, Senior Lecturer in the School of Education at the University of Limerick for offering a critique of an earlier draft of this chapter.

Caring about Early Childhood Education
DOI: http://dx.doi.org/10.5772/intechopen.104674

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Chapter 2

Next-Generation Science and Engineering Teaching Practices in a Preschool Classroom

Hye Ryung Won and Hyesun You

Abstract

This chapter examines how Next Generation Science Standards (NGSS)-based science engineering practices are embodied in preschool science, technology, engineering, and mathematics (STEM) teaching. A preschool teacher's three STEM lessons were observed, videotaped, and analyzed. The teacher's teaching practices were coded in a deductive manner using an instrument developed based on the NGSS science and engineering practices (SEPs) framework. The findings demonstrate that (1) the teacher mainly implemented two SEPs—obtaining, evaluating, and communicating information, and planning and carrying out investigations, (2) her teaching practices did not entirely cover all the SEPs of the NGSS, and (3) one important teaching practice, "redirection," emerged as a strategy used to shift children's attention or off-task behaviors into active engagement and emotional security. This case study provides insight into what SEPs preschool teachers can integrate into their STEM lessons and the limitations of specifically designed lessons. Implications and directions for promoting STEM teaching and future professional development strategies for preschool teachers are suggested.

Keywords: Preschool STEM, science and engineering practices (SEPs), teaching practices

1. Introduction

Extant research has emphasized the importance of introducing science, technology, engineering, and mathematics (STEM) at an early age to engage young children in rich STEM experiences (e.g., [1, 2]). Especially, appropriate early childhood STEM experiences nurture children's interest in STEM, enhance their STEM literacy, and reduce their stereotypes concerning STEM-related fields [2]. Children's natural desire and abilities for STEM learning [3] could be encouraged using developmentally appropriate teaching [4]. Yet, reform-oriented teaching practices for early childhood STEM education have received minimal attention [5]. Moreover, recent research suggests that effective science-relevant activities rarely occur in preschool classrooms [6, 7]. One possible reason for the lack of preschool science is that early childhood teachers have expressed negative dispositions and beliefs toward STEM. They also lack confidence in teaching STEM and have limited content and pedagogical content knowledge (PCK) [8, 9].

Relatedly, inadequate teacher preparation or professional development would be a critical barrier to successful STEM learning for young children.

While efforts to address the barriers are underway, the urgency of this need is reflected in the new era of the Next Generation of Science Standards (NGSS), whereby students are expected to learn about how to think like scientists and engineers and have a deep understanding of disciplinary core ideas (DCIs) and crosscutting concepts (CCCs) [10]. The NGSS clarified the goal of teaching science: teachers allow students to reveal their knowledge by "doing" a task using that knowledge [11]. These documents highlight what practices teachers can enact and how the practices are central to achieving educational reform. The NGSS has challenged early childhood teachers to align their STEM teaching practices with their standards and expectations [12]. However, there is a lack of evidence concerning the extent to which early childhood teachers incorporate NGSS-based SEPs into their STEM lessons [13]. The current study sought to fill this gap in the literature by examining one teacher's STEM teaching practices in terms of their alignment with NGSS at the preschool level. One of the challenges of examining teachers' NGSS-based STEM teaching practices is how to evaluate instructional quality. Commonly used instruments to observe teacher practices in early childhood classrooms are not designed for science instruction (e.g., [14, 15]). Furthermore, frequently used observational instruments in science education (e.g., [16, 17]) have typically been designed for upper elementary or secondary teachers.

This study captured one preschool teacher's instructional practices aligned with NGSS's science and engineering practices (SEPs) using the Systematic Characterization of Inquiry Instruction in Early Learning Classroom Environments (SCIIENCE) instrument [18]. The purpose of this study is to document a model of inquiry-based STEM lessons in early childhood education guided by the question:*RQ) How are NGSS-based SEPs embodied in preschool STEM lessons?*

2. Literature review

2.1 Impact of STEM reform in early childhood education

Over the past decade, there has been a growing body of conversation regarding early exposure to STEM [19, 20]. In 2010, the "STEM in Early Education and Development Conference" was held by early childhood scholars and researchers in response to increasing attention and the convergence of the two fields: "early childhood education" and "STEM" [21]. In 2014, the National Science Teacher Association (NSTA) [22] issued a position statement "Early Childhood Science Education" with the National Association for the Education of Young Children (NAEYC) to affirm that early engagement in science and engineering practices can foster young children's foundational skills needed for learning in their schooling and throughout their lives. In 2016, the White House held an "Early STEM Learning Symposium" in collaboration with the U.S. Department of Education, U.S. Department of Health and Human Services, and Invest U.S. Following that, a forum "Fostering STEM Trajectories: Bridging ECE Research, Practice, & Policy" was held with the cooperation of the National Science Foundation (NSF), Joan Ganz Cooney Center, and New America. In these two meetings, scholars, practitioners, and policy experts shared ideas about providing high-quality STEM education for young children. The discussions soon became an anchor for the release of two NSF-funded policy reports in 2017: "Early

STEM Matters: Providing high-quality STEM experiences for all young learners" [23] and "STEM Starts Early: Grounding Science, Technology, Engineering, and Math Education in Early Childhood" [4]. Each report provided an understanding of STEM disciplines, the importance of beginning STEM education early, and recommendations for policy, research, and practices to establish better early childhood STEM education. All of these events, actions, and issued documents illuminated that STEM education has already been a significant consideration in the early childhood education field and articulated a vision toward STEM education for young children having ages of 3–8 years.

2.2 NGSS-based teaching practices

One key aspect of the NGSS vision is using science and engineering practices (SEPs). The SEPs are multifaceted, encompassing practices that help students engage with and learn about science and engineering. In keeping with NGSS-based SEPs, teachers should implement instructional behaviors, including a) asking questions and defining problems, b) developing and using models, c) planning and carrying out investigations, d) analyzing and interpreting data, e) using mathematics and computational thinking, f) constructing explanations and designing solutions, g) engaging in argument from evidence, and h) obtaining, evaluating, and communicating information.

Beyond "knowing" the science concepts, students are expected to develop their understanding to explore the natural world through scientific inquiry and to solve problems using the practices of engineering design. Windschitl et al. [24] suggested four core instructional practices:

1. Constructing big ideas

2. Eliciting students' ideas to adapt instruction

3. Helping students make sense of material activity

4. Pressing students for evidence-based explanations

Kloser [25] also identified a set of core science teaching practices: (a) engaging students in investigations, (b) facilitating classroom discourse, (c) eliciting, assessing, and using student thinking about science, (d) providing feedback to students, (e) constructing and interpreting models, (f) connecting science to its applications, (g) linking science concepts to phenomena, (h) focusing on DCIs, CCCs, and SEPs, and (i) building a safe and collaborative classroom community. Most of the key ideas of practices shown in Kloser's study overlap with the NGSS SEPs.

2.3 Review of teaching practices in preschool STEM

This section illustrates instructional practices employed in STEM activities in preschool settings. Three commonly used instructional practices across preschool STEM education research were found from a rigorous review of the literature: 1) incorporating play, 2) relating learning to real life, and 3) engaging in a group task.

2.3.1 Incorporating play

Intentional incorporation of play as a part of STEM activities has been one of the most prominent teaching strategies in research regarding preschool STEM education. Previous literature has reported that playing meaningfully promotes children's basic STEM knowledge and skills in context. Torres-Crespo et al. [26] purposefully set up 20 minutes of free block playtime for 2 weeks in their STEM Summer Camp program and found that free play extended the opportunity for children to demonstrate their complicated engineering skills, helping them build more complex and taller structures. Similarly, Bagiati and Evangelou [27] set up free playtime to be followed by a small group engineering activity such as designing and creating structures. This smooth transition encouraged children to incorporate their constructions built during the STEM lesson naturally into their own play, whereby they could expand their scope of engineering skills. The natural transition from learning to free play appeared in Aldemir and Kermani's study [28] as well. The two classroom teachers, guided by the researchers for STEM instructions, intentionally left activity materials used in a STEM lesson in the center of the classroom right after the STEM lesson was completed. This activity provided a chance for free exploration by the children to revisit and regurgitate their learning spontaneously.

According to the developmentally appropriate practices (DAPs) [2], children's play is an important vehicle for promoting the development of content knowledge. The opportunities for decision-making and free-choice activities during play can empower children to construct knowledge in the most meaningful ways. In this perspective, integrating free playtime intentionally for STEM education purpose may be able to stretch the boundaries of children to the fullest in their imagination and enables them to practice newly acquired STEM skills.

2.3.2 Relating learning to real-life contexts

Authentic learning allows students to meaningfully apply what they learned in the class to real-world problems and continue to construct concepts in a relevant context. Connecting classroom learning to students' real-life situations has been found in preschool STEM studies to make learning authentic [5, 26, 28, 29]. Some of these studies focus on engineering by relating school learning to students' living contexts [5, 29]. For example, in Aldemir and Kermani's study [29], children observed a historic bridge in their community to make sense of the building process. After the observation, the children were encouraged to draw a bridge layout that they would like to build and construct their own three-dimensional bridge using their conceptual understanding of the engineering process. Similarly, in Tippett and Milford's study [5], the preschool children had a chance to design and build local birds' homes after they discussed birds living in their community.

Other studies illustrate how relating school learning to the human world promotes students' conceptual understanding of "technology" [26, 28]. In Sullivan et al.'s study [28], children were exposed to the question of how technology affects daily human life. During the intensive STEM program, the participating children investigated the use of real-life tools that could be found around their homes and community. Then, they engaged in the engineering design process in building "Robot Recyclers" by using the tools. The Robot Recyclers were programmed by inviting people living in their community to an open house to demonstrate how robots help human lives. Similarly, in Torres-Crespo et al.'s study [26], children were actively involved in making various electronic tools used daily during the STEM Summer Camp. Children had an opportunity to design an open and

closed circuit using electronic tools such as a battery, a buzzer, and LED bulbs with wires. They understood the principle of how circuits work, what makes electronic devices function, and whether malleable conductive dough can replace the role of wires.

The STEM tasks above, including building bridges, birdhouses, recycling robots, and electronic circuits, meaningfully draw upon children's life experiences by relating their newfound knowledge to engineering and technology. Furthermore, these activities have helped children understand that learning is not isolated to the classroom.

2.3.3 Engaging in collaborative tasks

Early childhood communities naturally foster peer interactions and collaborations, which help children go beyond their current level of knowledge and skills [30]. Some studies examined how children complete STEM tasks in groups [26, 31, 32]. Master et al. [31] reported that preschool children demonstrated more interest, persistence, and belongingness when doing group work. The study also described that the group assignment stimulated them to spontaneously engage in peer interactions and collaborations to achieve their shared goal, resulting in a better performance in tasks than the children working individually. Likewise, Torres-Crespo et al. [26] included group tasks as a part of their STEM program to create a space for children "to establish a plan of action and solve the presented problem as a group" (p. 13). The authors revealed that cooperative learning experiences help children feel more excited about learning and engage in more interaction.

Many studies argued the necessity of group work as "interacting in groups provide a driving force for children to extend their thinking, build on one another's ideas, and cooperate to solve problems" ([33], p. 15). From this perspective, the group task compels children to go beyond their abilities in the process of collaboration with peers and build more rigorous knowledge and skills in STEM to be used in solving problems.

3. Methods

3.1 Participants

A preschool teacher, Mrs. Alice (pseudonym), and eight 3–5-year-old students at a STEM-focused preschool, located in the southern region of the United States, voluntarily participated in the study. The teacher worked at the preschool for 3 years and had previously taught in an elementary school for 3 years. Although her undergraduate degree was in English, she had a strong interest and inclination toward science.

3.2 STEM lessons

For the current study, three STEM lesson units ("Measuring Distances," "Floating Boats," and "Cutting Clay") were chosen among the 20 lesson units collected because these three lessons were well aligned with Gagné's Instructional Design Framework [34]. The first unit, "Measuring Distances," utilized different height levels (0–5 inches) of a ramp to observe and analyze distances that toy cars traveled. The second lesson, "Floating Boats," provided the opportunity to learn about the floating or sinking characteristics of boats. The boats made of different material types (wood, metal, and plastic) were utilized to examine how long a boat could stay afloat when increasingly weighted with plastic gears. The third lesson, "Cutting Clay," utilized four

distinct objects (sharp rock, wood knife, metal spoon, and plastic knife) for children to observe and analyze which tool was best at cutting clay.

3.3 Data collection and analysis

This study aims to identify and explore one preschool teacher's SEPs used in the STEM-integrated lessons. We employed a single case study approach to gain an understanding of how the SEPs were built up in the lessons. A case study approach [35] allowed us to focus on a single unit anchored in an actual preschool classroom setting with multiple data collection techniques. The case study is "an empirical method that investigates a contemporary phenomenon in depth and within its real-world context, especially when the boundaries between phenomenon and context may not be clearly evident" ([35], p. 15). This qualitative study elucidates SEPs' components and provides information to develop reform-oriented teaching practices.

Twenty STEM lessons were observed for a month by positioning a camera toward the rear of the classroom. In addition to video recording the teacher's practices and interactions, field notes were used to document observations concerning how the teacher engaged with the students. All of the recordings were transcribed verbatim, and three STEM lessons among the 20 were chosen to be coded for the current study. Codes were generated using Kaderavek et al.'s [18] Systematic Characterization of Inquiry Instruction in Early Learning Classroom Environments (SCIIENCE). This instrument was designed to capture the ways in which teachers' instructional practices and behaviors were aligned with the NGSS. The coding system consisted of a total of 33 frequency codes for the eight SEPs. For example, two codes (student model and model discourse) captured the Developing and Using Models SEP.

Three researchers individually coded each video in 2-minute intervals. The duration of each lesson ranged from 30 to 45 minutes. After individually coding the observed interactions, the researchers compared their results and discussed any discrepancies. A consensus was reached on all codes, and each category of interaction frequencies was computed. The data were also analyzed from a qualitative perspective.

4. Results

Alice's teaching practices revealed that she mainly implemented two SEPs in her STEM lessons: *Practice 3—Planning and Carrying Out Investigations* and *Practice 8—Obtaining, Evaluating, and Communicating Information* (**Table 1**). In Practice 3, the most frequent code was "observation." For example, she encouraged the children to observe their own and others' experiments. This allowed them to engage in inquiry activities by observing and recording data. The following excerpt from "Measuring Distance" illustrates how Alice facilitated the children's observation and inquiry.

- T: Do you want to do a test with this?

- Lucas: (places car on ramp and pushes it to run. His car travels farther than the control car)

NGSS science and engineering practices	SCIIENCE Codes	Measuring distances	Floating boats	Cutting clay	Total
Practice 1: Asking Questions and Defining Problems	1.a Prior knowledge	1	2	1	4
	1.b Elicit hypothesis	3	5	1	9
	1.c Student idea	2	3	1	6
	1.d Misconception	0	2	0	2
Practice 2: Developing and Using Models	2.a Student model	0	0	0	0
	2.b Model discourse	0	0	0	0
Practice3: Planning and Carrying Out Investigations	3.a Information gathering	5	10	4	19
	3.b Test hypothesis	4	10	5	19
	3.c Equipment	5	8	6	19
	3.d Test solution	0	0	0	0
	3.e Teacher demonstration	0	2	2	3
	3.f Student inquiry	7	10	5	22
	3.g Observation	6	14	5	25
Practice 4: Analyzing and Interpreting Data	4.a Analysis/ interpretation	5	3	6	14
	4.b Overarching relationships	0	0	0	0
	4.c Move past misconception	0	0	0	0
Practice 5: Using Mathematics and Computational Thinking	5.a Numerical summary	4	6	2	12
	5.b Graphical summary	0	0	0	0
	5.c Quantitative conclusion	0	2	0	2
Practice 6: Constructing Explanations and Designing Solutions	6.a New situation	0	2	0	2
	6.b Explanation	0	6	6	12
	6.c Design solution	0	0	0	0
	6.d Evaluate understanding	0	0	0	0
Practice 7: Engaging in Argument from Evidence	7.a Disagreement	0	2	2	4
	7.b Evidence	0	0	0	0

NGSS science and engineering practices	SCIIENCE Codes	Measuring distances	Floating boats	Cutting clay	Total
Practice 8: Obtaining, Evaluating, and Communicating Information	8.a Documentation	6	5	6	17
	8.b Vocabulary	12	15	7	34
	8.c Open-ended questions	0	4	0	4
	8.d Sequenced questions	1	6	0	7
	8.e Clarification	1	5	5	11
	8.f Expository text	0	0	0	0
	8.g Technology	0	0	0	0
	8.h Assessment	0	1	0	1
Practice 9: Getting Attention or Inviting into Inquiries	9.a Redirection*	11	14	7	32

**Represents a new code emerged from the data.*

Table 1.
SCIIENCE code frequencies in three lessons.

- T: Okay, which one went farther?
- Lucas: Blue car.
- T: The blue one! Was that the one on the ramp, or not on the ramp?
- Lucas: On the ramp.
- T: So, you observed that the one used on the ramp went farther by three inches. Now we are going to measure the distance with a tape measure!

The data suggest that a critical element was the STEM lessons' introduction, during which the teacher engaged students in the repetitive ritual of making predictions. The children were given an opportunity to share their own hypotheses. Then, by sharing with their peers, the children became curious and actively engaged in the activities. This process eventually led to the students being prompted to test their own hypotheses. In sum, they were guided in ways that allowed them to engage in scientific inquiry as illustrated in the following example:

- T: So, everyone, let's make a hypothesis whether the cars are going to travel farther with the ramp or without the ramp. What do you think?
- Evie: With the ramp!
- T: What do you think, Gavin?
- Gavin: I think with the ramp.
- T: Most of your friends have hypothesized that the cars will go farther with the ramp. Okay then let's see which one goes farther.

The data indicated that the teacher also emphasized *Practice 8—Obtaining, Evaluating, and Communicating Information.* The most frequent teaching narrative code was "vocabulary" in Practice 8. The teacher frequently reinforced relevant science vocabulary, and the emphasized science terminology helped engage the students in effective scientific communication. Our qualitative analyses revealed that Alice emphasized scientific vocabulary such as "experiment," "test," and "hypothesis" in her lessons. For example, the following was observed during the "Cutting Clay" lesson:

- T: Which one do you think cut best out of these four? The metal? Is that your hypothesis?

- Cate: I think the rock.

- T: You think the rock? So, Cate's hypothesis is the rock. Do you guys remember what hypothesis means? That means your prediction, or your guess about what's gonna happen.

The teacher also clarified the vocabulary she used by questioning, explaining, and defining. In doing so, she guided the children's thought processes and encouraged them to engage in scientific inquiry.

In all lessons, Alice recorded the numeric data obtained from the children's experiments. The recorded documents were not only used as an aid for comparing different test values, but also served as crucial evidence from which to draw conclusions. That is, the teacher used the document data to help children determine whether their hypotheses were supported visually. The following is an example from the "Floating Boats" lesson:

- T: Look, this is our data sheet. So, which number is the biggest number you see?

- Arnold: This is the biggest number.

- T: You are right! So, among our plastic, our metal and our wood boats, the plastic held the most coins. So, that would probably be the boat that I would choose to sail on, because it holds the most materials. What about Billy? Which boat would you choose to sail across the ocean?

In sum, the observed teaching practices included not all of the NGSS SEPs for early childhood STEM teaching [18]. Only two-thirds of the 33 codes were observed. However, her frequent use of scientific words, generating questions, and documenting results modeled the scientific inquiry process. One important teaching practice emerging from the data was redirection, a strategy used to shift children's attention or off-task behaviors into active engagement, positive attitudes, and emotional security. For instance, whenever a child used her leg to block a test car from running down a ramp, Alice invited the child to be an active member of the experiments rather than simply eliminating her away from the experiment spot.

- T: Julie, you are on the right in the middle of our experiment. Can you please put your leg here?

- Julie: (Keeping trying to block her peer's car that rolls down on the ramp with her legs)

- T: You seem very curious about what we are doing! Do you wanna help us to do with this experiment? What role do you want to take? What about you become a test watcher so that you can judge whose car went farther!

- Julie: (Nodding her head and watching Peter's experiment)

- T: So now, Julie, would you like to measure how Peter's car went far? Here is a measuring tape for you.

- Julie: (Measures the distance that Peter's car moved)

- T: Ok, here we go!

- Julie: Now my turn! I will roll the car down on the ramp.

The approach prompted this child to modify her off-task behaviors into positive engagement in the inquiry-based learning without negatively affecting her emotion. Although this teaching practice is not directly related to SEPs, it could be an essential element of teaching STEM to this age group.

5. Discussion

A number of existing studies revealed that there are benefits of early exposure to STEM learning for children's intellectual growth. Teachers' instructional practices play a critical role in effective STEM learning. The NGSS's SEPs suggested how STEM teachers can implement instructional practices and, in the same vein, young children can conceptualize the scientific process, ask scientific questions, and observe and investigate their environments and the larger or smaller world around them [10, 36]. However, preschool teachers could be challenged because they are not familiar with instructional practices emphasized in the current reform [13, 37].

Our research provides insight into what practices teachers can integrate into their lessons and the limitations of some types of STEM lessons. Observation of Alice's classroom helped us to gain a comprehensive view of teaching practices and the challenges of adhering to the NGSS. Alice employed diverse SEPs; however, it was found that she still showed a lack of some practices such as building models and argumentation. The modeling practices are used to construct and apply conceptual models of physical phenomena as a central piece of doing science [38]. Jackson et al. [39] stated that "Students in modeling classrooms experience first-hand the richness and excitement of learning about the natural world." (p. 10). Modeling instruction can be performed in two main cycles in the preschool classroom: model development and model deployment. In the model development stage, teaching instruction typically begins with a demonstration and class discussion to have a common understanding of a topic or a concept. The children present and justify their thoughts and ideas in oral form, including the formulation of a model for the phenomena [39]. Students apply their understanding obtained from a discovered model to new situations during the model deployment stage to refine and deepen their understanding.

In addition to the modeling practice, argumentation was another teaching practice that was not found in Alice's lessons. Scholars indicated that argumentation is a blurred concept in early childhood education, which has led to less attention on the

way argumentation begins to take shape in the early years. Argumentation is conceptualized either as a product of individual reasoning or as a process arising from the interpersonal exchange of views [40]. Previous literature suggested that preschool teachers could build an ideal setting for discussing a shared topic with conversational patterns, including closed/open questions, agreements/disagreements, and adversatives [41]. Also, other scholars suggested argumentation's benefits in preschool for improving children's ability to cultivate shared and critical thinking [42, 43].

Exploring teaching practices can help researchers and educators construct a more informed understanding for building learning environments, where all the students can engage in various instructional practices for doing science. The investigation on the NGSS-based teaching practices implemented in a real education setting can provide a more comprehensive rationale for promoting science teaching and future professional development strategies and may have a growing influence on national and subnational education policies. However, based on the findings, this study still raises more questions than it answers. How confident (or challenging) are preschool teachers in enacting the NGSS SEPs? What conditions and expectations might support the move toward effective reform-oriented teaching practices? What alternative teaching practices could be integrated into existing knowledge and practices? Continued investigations are needed to discover and develop more practical strategies to support preschoolers' learning and teachers' initiatives for STEM learning. For example, examining effective teacher communication strategies, such as redirection, helps teachers who are newly attempting to infuse STEM into their teaching stimulate children's exploration around STEM concepts.

Meanwhile, more research is needed to understand the inquiry cycle in preschool STEM by the reform-oriented practices. Indeed, it has been emphasized that STEM education in early childhood education needs to invite young children into the scientific inquiry cycle [44] to incorporate their natural curiosity into the inquiry process. For that reason, many studies have shown how preschool science teaching and learning can be implemented within the inquiry cycle process; yet, there are only a few studies that provide a detailed description of what preschool STEM teaching practices conducted within the inquiry cycle process look like. There is a possibility that STEM education takes a different route from the inquiry cycle to what science education has taken since STEM education places a higher emphasis on innovation and creativity, which are not the primary skills emphasized in conventional science education. For that reason, exploring teaching practices with the inquiry cycle of STEM education compared to traditional education of science would provide useful insights into creating quality STEM implementation frameworks in preschool settings.

The SEPs in the NGSS may raise the bar for teaching science in K-12 classrooms. The NGSS SEPs are inherently linked to inquiry and engineering design and practices and provide real-world concepts. Preschool teachers who tend to be underprepared for inquiry-based teaching could bridge diverse students' previous knowledge and experiences to the SEPs and support their students' thinking and acting scientifically. Science process skills in the SEPs are helpful for the active exploration of science concepts: "Engaging in the practices of engineers likewise helps students understand the work of engineers and the links between engineering and science" [36], p. 42]. Additionally, the quality science instruction promoted by nurturing SEPs in learning big ideas in science is crucial for students' academic development. Thus, the findings from this study shed some light on what teachers know and can do as they become experts in engaging students in the authentic practices of science.

Besides, the NGSS address diversity and equity issues. The NGSS were developed as standards that offered promises of science teaching and learning that present learning opportunities and demands for all the students and particular student groups that have traditionally been underserved in science classrooms [45]. The NGSS Diversity and Equity Team tried to ensure that the standards were accessible to all the students, especially those traditionally underserved in science classrooms [41]. The students were defined as economically disadvantaged students, students from minority racial and ethnic groups, students with disabilities, and students with limited English competence. For example, appropriate SEP engagement in the SEPs allows all the students to comprehend and communicate their science ideas using "less-than-perfect English" [46, p. 6]. This shows the NGSS's vision of science teaching and learning that presents learning opportunities and demands for all the students.

Currently, underrepresented student groups are the majority across the nation [47], and the contribution of the SEPs to equity has become more critical [10]. Several studies showed the development process of instructional materials based on the NGSS, focusing on equity. For example, Hass et al. [48] presented the conceptual framework focused on equity that guided the development of NGSS-aligned instructional materials for the fifth grade with a focus on English learners. The authors unpacked a target set of performance expectations in terms of the specific elements of the three dimensions of the NGSS. Through unpacking, the authors selected phenomena that are local and relevant to all the students to consider students' everyday experiences as resources and entry points for inclusion in the science classroom. Campbell and Lee [49] also highlighted the need for instructional materials which attend to student diversity and equity and developed research-based instructional materials designed for the NGSS with a focus on student equity and professional teacher learning. However, the authors agreed that there are still tensions in developing new teaching materials to address the equity issues. Hass et al. [48] mentioned that addressing all three dimensions of each performance expectation would be a challenge. Another tension involves capitalizing on students' everyday experiences across various places within and across formal and informal settings [50]. Specifically, Miller and Saenz [51] pointed out that preschools have notable differences in materials and instructional practices children encounter. These differences revealed significant gaps in opportunities to engage in the different SEPs, which raises questions about equity in early science learning environments. There are various ways to address the equity concern; yet, the challenges of preschool teachers remain a critical puzzle to solve for policymakers and educators.

Science instructional practices aligned with the NGSS have the power to transform science learning and teaching, especially when accompanied by teachers' professional development and equitable curricula support. This current study recognizes the enormous task that this paradigm shift will require of teachers, educators, and school systems. Curriculum designers and researchers must think systemically about how early childhood teachers can be actively engaged in the NGSS SEPs and how they can develop equitable instructional materials for all the students.

DOI: http://dx.doi.org/10.5772/intechopen.105564

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Chapter 3

STEAM Implementation in Preschool and Primary School Education: Experiences from Six Countries

Camelia Delia Voicu, Maria Ampartzaki, Zuhal Yilmaz Dogan and Michail Kalogiannakis

Abstract

This chapter presents a survey focusing on pre-primary and primary STEAM education in six countries. The survey sought to identify: (a) the perceptions of teachers, parents, and professionals from STEM and the Arts (hereafter STEAM professionals) about the STEAM approach; (b) teachers' training needs; (c) teachers', parents', STEAM professionals' perceptions of the value of the STEAM's role in increasing the participation of young girls and disadvantaged students in STEM. Data was collected through focus-group interviews and were qualitatively analyzed. Results showed that teachers, STEAM professionals, and most of the parents had positive perceptions of the STEAM approach; they believed that it increases children's motivation and engagement in learning, regardless of the child's gender; it increases creativity, self-confidence and offers good learning opportunities for both boys and girls, taking into consideration their emotional and social abilities. The main difficulties identified were related to curriculum limitations, school infrastructure, and lack of resources, experience, and training in the STEAM approach. Teachers highlighted the need of training on the STEAM philosophy, essential concepts, and specific methods; access to STEAM-specific digital resources/software; practical training/seminars or blended learning training. Student teachers emphasized the need for more STEAM lessons in their initial training.

Keywords: early childhood education, STEAM, inclusive education, preschool education, primary school education

1. Introduction

Science in the postmodern era endorses the principles of democracy and justice, critical sustainability, and transformation for an equitable future [1]. On the same plane, Science education has evolved to (a) meet the needs of an increasingly diverse society [2], and (b) reorient learning by adopting the principles of "transdisciplinarity," "political citizenship" and "philosophical values," overall, implementing science education through "interdisciplinary sessions in science and humanities" ([3], p. 106).

It comes to no surprise that, in this perspective, curriculum developers sought to link Science with Technology, Engineering, and Mathematics (STEM) [4], to construct "contextualized knowledge" ([5], p. 79, 89), that is, knowledge meaningful to the learners [1]. The so-called STEM approach was developed to promote learning linked to the authentic needs and the interdisciplinary developments of the modern world [6]. The STEAM approach is also believed to support the general social–emotional learning [SEL] and development of the child. Through collaborative and interdisciplinary tasks and projects that involve processes of inquiry and problem solving, children are provided with the opportunities to develop the core social and emotional competencies as named by the Collaborative for Academic, Social, and Emotional Learning (CASEL) [7–10]. However, more research is needed on this, as studies provide an inconclusive picture of the link between STEM and SEL so far. A review by Garner and Gabitova [11] revealed that research has not yet shown if STEM needs to be infused with SEL elements and/or strategies to become a holistic approach or if SEL will be the typical result of a consistent STEM approach (see also Ref. [12]). In the meantime, a holistic approach that accommodates STEAM in meaningful interactions, real-world inquiries, and play is highly advisable [9]. Research revealed the benefits as well as the gaps and deficiencies of this approach, as learners in STEM still fell behind in creative skills and innovative thinking [13]. This led to the addition of Art to the STEM subjects (hence the abbreviation STEAM) and a new approach that was enhanced by humanities [3].

The STEAM approach continues to develop but is this an approach that can materialize a postmodern approach to education? Art was initially introduced to "promote curricular integration between science, technology, engineering, mathematics and the arts favoring deep and collaborative learning on students" ([14], p. 2), and to "promote creativity together with rationalization" ([15], p. 1). As such, the STEAM approach adheres to the principles of Western modernism, utilitarianism, and liberal education perspectives. However, Art can potentially move STEAM to a critical postmodern level.

What Art integration can contribute to STEM lies in "the epistemic practices in the arts" ([16], p. 24), which can be grouped into the following categories: *Technical and critical practices, creative practices, and ethical practices* ([16], p. 27). Technical and critical practices in Art include the close examination of matters and the deconstruction of parts to reveal the "meaning" behind the compilation of different construction elements [16]. Applying this process can help STEM to critically deconstruct major discourses and question theoretical frameworks and definitions. The creative practices include the integration and manipulation of "multiple sign systems," multiple principles and ideas, as well as the artistic augmentation of meaning ([16], p. 27). The multiplicity imposed by the artistic creative processes can enhance the convergent thinking promoted by STEM with the divergent thinking promoted by Arts, and the communicative actions [17, 18] used for scientific negotiation. The ethical practices include negotiation and rigorous evaluation of the quality of a project [16]. Ethical practices are needed in STEM to ensure that projects "are of value to a larger community" ([16], p. 24) and strive for the betterment and sustainability of society [19].

Moreover, to move to a critical postmodern level, STEAM will have to address equity issues [1]. More specifically, the STEAM approach must address (a) the gender disparities and (b) the barriers disadvantaged students face in STEM education and STEM careers [2].

Recent reports stress that STEM professions are not attracting young 'people's interest and learners lack the appropriate skills to pursue STEM careers [20]. In Europe, STEM professions are among the "top five shortage occupations" ([21], p. 1). Research also identifies that there is a gender underrepresentation in STEM

professionals. Girls and women are less likely to pursue STEM careers even if they are not lacking skills and knowledge in STEM subjects throughout their school life [22].

Research investigating the reasons behind this underrepresentation identified factors affecting girls' and women's choices at an individual and environmental level. At the individual level, research shows factors such as personal interest, self-confidence, or motivation [23]. At the environmental level, these factors include stereotypes about gender and STEM [23, 24], parental beliefs, dispositions, behavior [23, 24], the presence of suitable female role models, and/or the provision of mentoring [25, 26].

Other research shows how the same two main categories of factors influence the choice of a STEM major among disadvantaged students as well. More specifically, the studies identify the following factors:

a. Individual factors [27] such as the intention to pursue a STEM career [27] and the motivation to attend STEM high schools and STEM courses.

b. Environmental factors such as (a) students' research experience [28]; (b) if the students had a mentor or a parent with a STEM career [24, 29, 30]; (c) the experience of supportive learning environments in the family or at school [30, 31]; (d) a sense of belonging at school [32–34]; and (e) the development of intellectual capacity for STEM [27].

Equity issues need to be tackled at an early stage as they appear at all education levels (pre-primary, primary, secondary, and postsecondary) [35].

The following pages present exploratory research on the perceptions and expectations of educational actors regarding STEAM education at the preschool and primary school levels.

2. Research methodology

2.1 The context of the research

The present chapter shows the results of a study carried out in six countries in the context of the "Next Generation Science Standards [NGSS] through STEAM" project, which was funded by the European Union (Erasmus+, Agreement No 2020-1-TR01-KA201-094463 2020). As a Key Action 201 "strategic partnership for school education," the project involved countries such as Türkiye, Romania, Greece, Bulgaria, Poland, and Lithuania. The project is coordinated by the Turkish National Agency (Centre for European Union Education and Youth Programs) and the Uskudar District National Education. NGSS is set to promote STEM and Arts (STEAM) in early childhood education through a novel approach that will focus on social and emotional learning (SEL), integrated with interactive approaches [e.g., drama, gamified learning, and physical education], involving social, emotional as well as cognitive skills. The ultimate goal will be to "enhance, encourage, and foster an innovative educational approach that integrates STEM and Arts learning in early childhood education through gender-inclusive methods and resources and promote a positive change of attitudes toward non-stereotyping choices in education" [from the NGSS funding application]. As such, the project addresses educational inequalities and targets the perceptions and expectations of educational actors regarding STEAM education at the preschool and primary school levels.

A needs analysis and curriculum analysis in each partner country had to be carried out to enable partner countries to establish common criteria for the estimation of the good practices within the project context and to offer background information for developing NGSS teaching resources for preschool and primary school teachers.

2.2 Research goals

The main objective of the needs analysis was to identify the opinions of the teachers, parents, and STEAM professionals on STEAM implementation ("good practices, difficulties, and strengths, effects"), with a particular reference to the "motivation and participation of girls and disadvantaged students in science education and careers." ([36], p. 16, [37]). Also, the researchers intended to identify teachers' "training needs" and "criteria of *good practices* from the teacher's perspective." Another research goal was to identify the "parents' perceptions of gender differences in children's play and/or school" and STEAM activities [idem].

2.3 Research methods and tools

Each partner organized and conducted a series of focus-group interviews targeting three types of stakeholders: (1) teachers (or student teachers) and management staff from preschools and primary schools, (2) parents, and (3) STEAM professionals. The interviews were structured following the list of topics displayed in **Table 1**.

The addressed topics were as follows: "subjects' knowledge and awareness of the difference between STEM and STEAM"; "teachers' difficulties (already experienced or anticipated) in implementing the STEAM approach"; "ways to overcome difficulties and obstacles"; "the type of support they had/or they believed should have received in implementing STEAM"; "STEAM education effects on children"; "types of motivational strategies teachers used/would like to use to ensure equity (that is strengthening girls' and disadvantaged children's participation) in STEAM lessons"; and "training needs." The interviews were recorded, transcribed, and subjected to qualitative content analysis.

The focus-group interview sessions were held online [using platforms such as Zoom, Microsoft Teams, and BigBlueButton] or face to face, according to the specific SARS-CoV-2 epidemic situation of each country. The duration of the focus-group interviews was between 1 and 2 h. The research subjects expressed verbally or signed [in face-to-face matching sessions] their consent; the consent form was previously agreed on by all project partners. European and national research ethics guidelines were previously discussed and agreed upon in the projects' transnational meeting, which prepared the focus-group implementation, and they were followed through all interviews [38]. In all interview meetings, the moderators presented themselves, briefed participants on the project, and asked the participants to say a few words about their professional status and work experience. The moderators also cultivated a good mood and trust, stressing that all opinions were valuable and would remain anonymous to obtain the sincerest answers [39, 40].

The focus-group interview contained two parts of questions. The first part included some general questions addressed to all groups of participants (pre-primary, primary and student teachers, STEAM professionals, and parents). The second part included questions geared to the three distinct groups of the sample separately, that is,

Part A. General questions (for all participants):
Topics/issues addressed:
1. Teachers' STEAM professionals' and parents' understanding of the difference between STEM and STEAM.
2. The strategies teachers could use to motivate and engage the pupils in science lessons.
3. The benefits schools could rip from collaboration with the international STEAM community.
Part B. Specific questions for each stakeholder group:
B.1 Topics/issues addressed to the teachers' sample (for pre-primary, primary, and student teachers alike):
1. The experience and knowledge teachers had about the STEM/STEAM approach.
2. The difficulties teachers and student teachers face/or could face in implementing the STEM/STEAM approach [difficulties related to infrastructure, logistics, the framework provided by the national curriculum, the design of the lesson plans, etc.].
3. Ways in which teachers can overcome these difficulties; aspects that can help the most or the least; and kinds of support teachers receive from policymakers or other stakeholders.
4. Teachers' expectations related to the implementation of STEAM.
5. Teachers' perceptions about the effects of STEAM teaching on children.
6. Strategies that teachers could use to motivate and engage pupils for STEAM lessons.
7. Teachers' experience in engaging the girls and disadvantaged students in STEAM courses.
8. Teachers' expectations from school management to help to teach female students.
9. Kinds of training, educational programs, materials, seminars, tools, and platforms that teachers would wish for when teaching STEM.
10. How well-prepared teachers feel about planning STEM/STEAM lessons.
11. Whether teachers feel that they need more training on STEAM, if they have taken any training courses, and what kind of support they need to become more efficient and motivate their pupils.
12. If teachers take students' SEL into account while teaching STEAM/or any science lessons, and if they plan special activities to motivate them.
B.2 Topics/issues addressed to STEM and Arts professionals:
1. Arts professionals were asked if they thought they were doing Science when creating Art.
2. Science professionals were asked if they thought they were creating Art when they were doing Science.
3. Both STEM and Arts professionals were asked about the methodology they use [when engaged in teaching] to make STEM/STEAM more attractive to girls and disadvantaged students.
4. Both STEM and Arts professionals were asked if they would do something [or wished teachers to do this] to help girls and disadvantaged students become familiar with tools and other devices.
B.3 Topics/issues addressed to parents of mainstream and disadvantaged pupils asked about the following:
1. Behavioral differences they notice among their children of different genders or while they learn Science and in their emotional reaction to scientific topics.
2. Differences they notice among their children of different gender in activities such as watching cartoons and playing with toys.
3. Choices of educational toys they make for their children in terms of SEL.
4. If they have ever talked to their children about the value of Science and Art and the topics the children were curious about.

Table 1.
Topics/issues addressed during the focus-group interviews [37].

the teachers (pre-primary, primary, or student teachers), the STEAM professionals, and the parents. **Table 1** presents in more detail the topics/issues addressed by each part of the questions.

2.4 Study population and sample

The study population was identified according to two main aspects, which were essential for the NGSS project: (a) the participants' occupational status in education and STEAM and (b) the parental status of children aged 4–11. The study population, therefore, involved three major categories of subjects: (i) pre-primary and primary school teachers (or student teachers) and educational management representatives, (ii) STEAM professionals, and (iii) parents of children aged 4–11 [36]. The study adopted purposeful sampling (also known as purposive sampling or intentional sampling), which is the sampling that uses the deliberate or intentional choice of the participants based on their qualities or characteristics that are important for the research [40, 41]. Also, for achieving the research goals, purposeful sampling offers the possibility to select subjects who are able and willing to provide needed information based on their experience and interest [40]. The specific, purposeful sampling technique used in this study was criterion sampling [42] since we need to comply with the project criteria for the target groups and obtain a comprehensive understanding of the issues from different educational stakeholders. Therefore, the sampling criteria were as follows: (i) the occupational status of the participants (in-service or student teachers and management staff from preschool and primary school education, STEAM professionals, and parents), (ii) the subjects' willingness to participate, reflecting their interest in the STEAM subjects, and (iii) the minimum number for each study population category as specified by the NGSS project (12 preschool and primary school teachers, four female STEM professionals, three female professional artists, and six parents, three of which should have children of different gender). Thus, the samples were not statistically representative of the national state of the partner countries, and the results can only be indicative of the general situation. The residential areas of the subjects were both urban and rural, and some lived in geographically and economically disadvantaged environments. The average teaching experience of all teachers group was between 10 years (in Greece) and 25 years (in Lithuania). The recruitment was carried out via open calls and distributed by the partners' communication channels.

The final numbers of the participants involved in the focus-group interviews are presented in **Table 2**.

2.5 Data analysis

For the data analysis, a deductive thematic approach was used to ensure unitary identification of the information targeted by the research questions, especially in the context of transnational research. Also, a deductive analysis helps maintain focus on the research purpose [42, 43]. This approach can be used when a researcher has a fair idea about the likely responses that will be received from the research subjects [42], and/or when the researcher is familiar with the research topic, or involved in the analyzed phenomenon [44]. In our case, the researchers already had the frames of reference/cognitions that helped them identify the meanings of the answers considering the purpose of the research. Given that all partner members involved in the focus-group interviews were familiar with STEAM in preschool and primary education and had the necessary information/cognitive frames for interview analysis, we

Country	Teachers	STEM + Arts professionals	Parents	Total per country
Romania	19	9 [8 female]	9	**37**
Türkiye	19	14 [12 female]	13	**46**
Bulgaria	18	5 [all female]	7	**30**
Greece	41: 17 student teachers + 24 professional teachers	10 [8 female]	9	**60**
Lithuania	12	7 [4 female]	6	**25**
Poland	20	8 [7 female]	10	**38**
Total per group	**129 teachers**	**53 professionals [44 female]**	**54 parents**	**236 participants**

Table 2.
Totals of participants in the focus-group interviews.

considered this approach best suited for the data analysis of the focus-group interviews. The deductive approach to analyzing qualitative data is based on a structure predetermined by the researcher, which is also reflected in the design of the interview and the main topics covered by the interview questions [39, 43]. In our study, the main topics became the themes used in the data analysis. Before starting the interview content analysis, they were presented and agreed upon within a transnational meeting with all research partners. Also, a template was developed and agreed upon within this meeting to clear up code definitions and eliminate unnecessary codes [45]. This template led to a unitary identification of the codes in all nationally transcribed interviews, assuring intercoder reliability and maintaining alignment with the research questions. [46]. The researchers coded the transcribed interviews by matching the codes from the template with segments of data [verbal and nonverbal responses of the participants] selected as representative of each code [47].

2.6 Research results

The results we present below follow the themes emerging from the data analysis and cover the main topics of the interviews.

2.6.1 Teachers and STEM and arts professional's previous experience and knowledge of the STEM/STEAM approach

Analysis revealed that most teachers and STEAM professionals from all the partner countries had a general idea about the STEAM approach. They knew the meaning of the STEM/STEAM acronym. Still, only a few had the experience of implementing it [mostly Lithuanian teachers and a few teachers from Türkiye, Greece, and Romania]. In general, they identified themselves as inexperienced or not prepared enough to teach the STEM or STEAM approaches. The Greek student teachers appeared to be more informed about the STEAM approach.

Except for Lithuanian primary teachers, who had some experience in teaching STEM/STEAM and were familiarized with specific methods, most of the teachers and STEAM professionals said they knew only a few of the particular didactic methods or strategies used in the context of the STEAM approach.

All the teachers, almost all STEM professionals, and most of the Arts professionals understood the need or the benefits of integrating Arts with Science and the ways to combine them. Most of the Arts professionals agreed that there can be Science through Arts and vice versa and could think of examples of how these domains can be correlated.

Overall, a slight difference was identified between teachers and STEM professionals regarding the knowledge of STEM philosophy and specificity. STEM professionals declared that they had greater access to up-to-date Science or Art education information.

The general attitude of preschool and primary school teachers and STEAM professionals toward the STEAM approach implementation was positive, highlighted by the openness and desire to know more and to try it in their educational endeavors.

2.6.2 Difficulties faced in implementing the STEAM approach

For most primary teachers and STEAM professionals that had previously experienced STEAM implementation or similar activities, the primary identified difficulties were as follows:

- The school's infrastructure (space and schedules) made it difficult to allow the interdisciplinary approach to the topics, as most teachers and Science or Art professors could not collaborate or consult each other.

- There is a lack of teaching materials/resources (e.g., technology and materials needed for experiments) or specific STEM spaces in the community (such as laboratories, botanical gardens, and museums) that could sustain proper STEAM implementation and ensure the safety of the children, especially when conducting experiments.

- Most teachers believe they lack expertise in the STEAM approach.

- The design and preparation of the lessons are time-consuming and create an additional workload for teachers, mainly in disadvantaged schools.

- The curriculum frameworks imposed some limitations on integrated teaching of the topics (in the case of Romania, Türkiye, and Bulgaria), especially in the case of upper classes (the 3rd and 4th grades), by dividing the teaching of the core curriculum subjects.

- Support from or collaboration with experts/professionals/teachers from the Science field is absent.

- Supporting educational policies related to STEAM education (except for Lithuania and Greece) are also nonexistent.

The lack of resources and curriculum limitations for preschool teachers did not create difficulties but rather challenges. They declared that teaching resources for these ages are more accessible or affordable, and they usually get more involvement from parents; also, they admitted that curriculum frames are more open to a creative and customized approach to the needs of learners and subjects.

In addition, teachers that had not previously experienced STEAM implementation highlighted difficulties in adapting to the level and specific needs of all children, especially in very heterogeneous classes, and a lack of adequate information, models for STEAM teaching, and training in STEAM implementation.

2.6.3 The support teachers had and ways of overcoming the identified difficulties

The interviews revealed that the teachers overcame or could overcome the obstacles through (i) personal interest, (ii) personal study and effort to understand and learn more on how to implement STEAM lessons, (iii) collaboration with a more experienced teacher or mentor, or with other colleagues interested in this approach, and (iv) adapting some examples of STEAM activities available on the Internet. Other ways that teachers used to meet the demands of a STEAM approach included:

- Involving parents to obtain resources for the lessons [Türkiye and Romania].
- Obtaining resources/support or financial support from other organizations within the community [e.g., universities nearby and commercial institutions] in the case of Türkiye, Lithuania, and Romania.
- Support from school management for teaching resources and school infrastructure difficulties, and support from the academic field for the teaching design/strategies [in the case of Türkiye and Romania].
- Support from the policymakers, only in the case of teachers from Lithuania, where the schools have a team responsible for STEAM education, and the teachers have got governmental training on STEAM methodology.

2.6.4 Teachers' training needs and readiness to implement STEAM education

The research revealed that most of the teachers did not feel quite ready to implement STEAM education, although they were willing and open to this type of approach. Only a few teachers from Lithuania and most teachers from Türkiye felt ready to implement STEAM activities.

Regarding the training needs, all teachers stated the need for more specialized training on STEAM, for a deeper understanding of the STEAM philosophy, ideas, methods, and the need for more teaching resources [preferably digital] such as lesson plans and educational materials. Also, the research highlighted the need for mentoring and sharing experiences between teachers, even transnational sharing, from the most experienced colleagues. Other training needs outlined by the interviews were as follows:

- The need to learn how to identify pupils' learning needs and learning styles, especially in the case of intellectually challenged children, and how to link the lessons with real-life problems.
- The need for learning innovative methods, and methods suitable for working with vulnerable children, not only discriminated but also abused or emotionally disturbed.

- The need for learning how to improve their collaboration with parents, and to increase the awareness of the teachers being role models and influencers for the future career choices of their students.

- The university students emphasized the need for more STEAM lessons in their initial training programs.

The data analysis also outlined the training resources teachers prefer: digital, open-source materials [e.g., ready implement lesson plans, papers describing step-by-step the educational methodology, examples of STEAM projects for different ages, or nonformal/extracurricular education projects based on or including STEAM approach], digital platforms or Apps suitable for STEAM implementation [with free access to use it]. Regarding the format of the training, teachers identified preferences were as follows:

- Practical training/seminars, "on the field" or blended learning training.

- More international projects and activities where they could share their experience with teachers from other countries [in the case of Lithuania, Türkiye, and Romania].

- Fieldwork in nonformal education providers, such as museums, aquariums, and planetariums.

- A "learning hub"—a physical or virtual space for teachers to meet peers, stakeholders, and other experts in their field of interest.

2.6.5 Teachers' opinion about the characteristics/attributes of a "good practice" in the STEAM education

The analysis of teachers' and STEAM professionals' answers revealed that teachers and STEAM professionals identify four dimensions of a "good practice" in STEAM education, which are as follows:

1. The engaging and motivational dimension: the activities should fully engage all children, regardless of their gender or disadvantages; should be attractive and should motivate children to learn; and should be inspirational and should increase children's interest, especially girls' interest and motivation for science education and work.

2. The implementation dimension: the activities should be easy to implement and should not require a great deal of time and many financial resources; also, the activities should include active tasks, hands-on experimentation, and teamwork.

3. The creativity dimension: the activities should accommodate creative, innovative, and engaging ways to do things, which could help children and teachers to think "out of the box" and should allow students to put their theoretical knowledge into practice in innovative ways, which could help the development of their mind, socio-emotional skills, and digital skills for both students and teachers.

4. The authenticity dimension: children must work and use authentic tools and instruments, not just toys, as this offers the possibility of obtaining meaningful artifacts that could be capitalized and promoted all over the country or the world.

2.6.6 Expected effects of STEAM teaching on children

The STEAM education value for children's development, reflected in teachers' and STEAM professionals` opinions, is comprised of four categories: cognitive development, socio-emotional development (including emotional skills, communication, and relationship skills with peers), learning motivation, and digital skills.

The value for cognitive development is derived from the increased quality of learning of the STEAM approach; in teachers' and parents' opinions, children find learning through STEAM easier, more pleasurable, and more active. Also, STEAM education helps children acquire scientific literacy and improve their critical thinking, inquiry, problem-solving skills, and creativity. In STEM and Arts professionals' opinions, STEAM education can offer ways for extracurricular learning opportunities for all ages and educational levels.

In teachers' and STEAM professionals' opinions, the value regarding socio-emotional and communication abilities is because STEAM activities help children to improve self-image, obtain higher self-esteem, strengthen perceived self-efficacy, increase resilience, tolerance, and empathy, and improve teamwork skills and assertive communication skills.

The value regarding children's intrinsic learning motivation and positive attitudes toward learning is derived from the fact that STEAM activities stimulate children's cognitive motivation (as curiosity, eagerness to know more), learning autonomy, and engagement (students are much more committed, more involved, and more eager to learn).

The value regarding digital skills is because STEAM education implies working with digital devices, use of the Internet, computer programming, coding, etc.

2.6.7 Social and emotional learning (SEL) integrated in a STEAM lesson or science education

All teachers highlighted that SEL is essential in all types of lessons. Many said that socio-emotional abilities can be developed in Science or STEAM lessons. However, some of the teachers were not able to specify how STEAM can contribute to SEL or, the opposite, how SEL can primarily contribute to successful STEAM lessons.

2.6.8 STEAM's role in increasing the motivation and participation of young girls in STEM fields of study and careers

Most of the participants from the groups of STEM and Arts professionals said they did not encounter gender discrimination or gender differences in Science or Arts classes, mainly referring to girls' involvement and motivation to learn and participate in activities. Teachers and STEM professionals stated that students display different psychological features such as temperament and attitude during learning, but their involvement in learning activities is not influenced by gender. All the teachers and some STEM professionals admitted that in their past experiences (as teachers or as students), they encountered some adult bias toward female participation in studying and working in Science fields. For example, teachers from Romania declared that some older teachers did not usually involve girls in doing experiments and/or solving Physics/Chemistry problems. In their present-day experience, teachers do not differentiate methods or tools for girls with the purpose of increasing their interest and involvement in the activity since girls' and boys' interest in Science does not depend on their gender.

Also, some schools in Türkiye still have to deal with girls' school dropouts due to early marriages or because of their parents' perceptions about the female role. They stated, therefore, that the parents should be educated and trained about gender equality starting from the early ages, because without parents' support, it is very difficult to keep girls in school. They also proposed strategies and solutions for the motivation and participation of girls and disadvantaged students: supporting collaboration among all students, using appropriate role models, and teaching according to the needs and interests of the girls and disadvantaged children.

2.6.9 Ways teachers and STEAM professionals make STEM/STEAM more attractive to girls and disadvantaged children

In teachers' opinion, children from economically disadvantaged families must deal with educational inequalities because they do not have material resources for all the learning tasks and activities. These children need to be financially and educationally supported. Also, the children from geographically disadvantaged groups need support from mobile teams of STEAM professionals and teachers or summer schools and extracurricular activities such as theater. These can be developed and offered in their settlements to help children learn different topics (from Sciences and even Humanities) through Arts. All the teachers and STEM and Arts professionals argued that STEAM activities would add greater value to children's education in these disadvantaged areas. All the teachers and STEAM professionals believed that the STEAM approach makes a difference and is an opportunity for all children to develop and deepen their knowledge and better prepare for their future professions. In respondents' opinions, the ways of increasing lessons' attractiveness to all the children are assuring what they defined as a "good practice" in teaching STEAM: easy, pleasurable, and interactive activities that fully engage all the children; lessons that allow peer coaching, and teamwork; and extracurricular activities (e.g., visits to museums and botanical gardens and outdoor workshops).

2.6.10 Parents' perception of gender differences

Almost all parents claimed that they had no problem allowing children of either gender to play or engage in all types of games and activities. However, some parents acknowledged some differences between girls and boys in playing with toys or in their choice of activities, depending on children's age. Some Bulgarian parents thought boys are mostly computer gamers and more active (they prefer balls, Lego, and cartoon characters), while girls are assigned to "calm" playing, such as mind and board games. In their opinion, this could be explained by stereotypical behavior children observe and parochial ideas that might be passed on to them through their environment, from older people, or even from younger ones.

2.6.11 Parents' perceptions of the value of science and art in children's education

Most parents (except those from Lithuania, where STEAM education is a popular topic) declared that they did not know much about the STEAM approach until they participated in the focus-group interviews, so they could not take a stand on the value of this approach for their child's development and education. Still, most stated that Art helps their children express themselves better and natural sciences are useful for the future career of their children. Discussion during the interview enabled parents to

understand what STEAM is and how children will benefit from it. So, they assumed that through STEAM, children could learn by playing, acting, and doing experiments. They also thought that this approach helps children to learn quickly and more effortlessly. Finally, all the parents identified the potential of the STEAM approach for creating opportunities to discover a child's special talents and abilities.

3. Discussion

The research results highlighted that, from a general perspective, teachers from preschool and primary school education, professionals in STEM and Arts fields, and even many parents are aware of the existence of STEAM education and have a minimum understanding of its philosophy. This offers a positive base for further development of educational policies of STEAM education since the need for contextualized knowledge, and interdisciplinary teaching is increasingly emphasized at a global level [5, 6, 48].

The research revealed differences between the teachers from the six partner countries in implementing STEAM in their classrooms. This difference is explained by the curriculum and school infrastructure limitations, lack of educational policies supporting STEAM implementation, and lack of adequate resources. Besides these difficulties, the lack of specific training and poor expertise in STEAM education were the main issues affecting its proper implementation in all six investigated countries. Good expertise for STEAM implementation is all the more important in the postmodern world when debating on social justice, sustainable development and an equitable future [1], and on "the reification of traditional gender roles in STEM and the influence of neoliberal ideology in STEM context" ([49], p. 1).

An encouraging similarity between the six countries is the identified training needs of teachers from both education levels—preschool and primary school—and identified ways of overcoming difficulties related to the lack of STEAM expertise. These show teachers' readiness for self-reflection, openness to professional growth, and the desire to improve themselves and the quality of their practice. This aspect is all the more important as teachers often feel threatened; their self-efficacy in STEAM implementation is often weakened as a result of lack of training, planning time, and material resources, in the context of a new emphasis on STEAM education in an "increasingly complex world" ([50], p. 1). The interest of Greek student teachers in STEAM education courses, modules, and seminars included in their initial training programs also reveal their awareness of the importance of training for their future STEAM practice and success [51]. The preferred training modalities and training resources teachers identified in all six countries were also common. They outline a familiar requirement of today's training: that we live and learn in a digital world that requires digital literacy [52].

Besides curriculum limitations and poor expertise for STEAM implementation, other difficulties reported in all six countries are the lack of infrastructure and proper educational materials. STEAM education requires schools to have a series of bespoke platforms, tools, pedagogical material, and a sizeable budget [53]. Primary school and preschool teachers in Türkiye and Romania suggested overcoming these difficulties, with parents' help, and this brings up the question for the potential of school-family partnerships as a formal support strategy for STEAM implementation at all education levels in all countries. It is worth considering that parents play an essential role in constructing children's professional aspirations and influencing their professional orientation [54, 55]. Also, the results highlighted the issue of school partnerships with local

or national institutions as being a key action for overcoming the difficulties related to the lack of proper teaching resources or the lack of STEM training, both in primary and preschool education [56, 57]. School collaboration with other educational institutions or economic organizations for the sake of successful STEAM implementation should also be on policymakers' agenda. In our study, only Lithuanian teachers reported support from policymakers or other similar stakeholders.

A positive aspect of teachers' perception, stemming from our results, is that teachers and STEAM professionals recognize the added value of integrating Arts within STEM in a formal education context. An obvious consequence is the awareness that an improved STEAM approach provides a framework for holistic childhood development through combining art, humanities, and design with specific science topics and methods [57]. Especially in early childhood education, when learners are developing their expressive language skills, it is relevant to use different media, such as artistic tools and techniques, to enable them to express their ideas and feelings [58]. At the same time, creative expression lays bare the fact that there will not always be one unique, correct answer. The tinkering part of arts is also important in future STEM learning. It provides a channel to express creativity and offers an opportunity to learn about taking mitigated risks when exploring novel ways to address specific challenges [59]. A series of visual arts lend themselves perfectly well to these activities, such as esthetics, visual literacy, and creative communication. Furthermore, they facilitate the learning of scientific concepts, the development of specific technical skills, and the ability to engage in interdisciplinary learning activities [60]. Also, exploration of pathways in which Arts enable STEM to address equity or epistemological shifts (i.e., to employ critical and ethical practices and perspectives) is highly needed [61–63] for a sustainable future [64].

A significant similarity between country data in our study is the meaning teachers attribute to a "good practice." This similarity is a positive aspect, reflecting a deep and widespread understanding of the means and value of STEAM education for children's development from early stages [51, 65]. However, these good practices require teachers to have good STEAM subject knowledge and skills to apply appropriate methods and identify the right competencies their students need to develop. Teachers need continuous training to acquire enough subject/topic knowledge to better understand what they want to teach, and pedagogical content and curricular expertise so that they can understand how to teach STEAM and assess the subsequent learning [66].

Another common perception held by teachers in all, six countries, refers to the value of STEAM implementation for children's development: STEAM education is perceived to promote creativity, collaborative and experiential learning, as well as resilience and problem-solving skills. These are crucial skills for tomorrow's political leaders, scientists, engineers, entrepreneurs, and teachers [16, 67]. In addition to this, it has been shown both by this study and literature review [65, 67, 68] that STEAM can offer ways for extracurricular learning opportunities for all ages and educational levels. STEAM is a new way to promote students' creativity, collaboration, and collective being through transdisciplinary consciousness and conscience [48, 67, 69]. The fact that STEM/STEAM initiatives are deployed globally shows a definite push toward a more interdisciplinary pedagogy, redefining the purpose of education [70]. In some countries, experiments on interdisciplinary strategies for college and high school teachers show that high school and college students use of STEAM technologies while studying physical and mathematical disciplines improves performance, reduces vulnerability, improves self-esteem, and expands their knowledge [71].

Although many teachers stated that social–emotional development is essential in STEAM teaching, they could not fully explain how STEAM education could contribute to the social–emotional development of school children. They also tended to offer a narrow definition of social–emotional skills, referring to empathy, cooperation, self-esteem, and assertiveness. This shows they could not identify and link STEAM to important SEL aspects such as self-control, self-confidence, self-awareness, and decision-making skills. STEAM competencies should be based on cognitive, as well as on social and emotional skills, to form active, critical, and informed citizens of our societies. A survey of the World Economic Forum predicted that the following skills are crucial in the current job market: problem-solving, critical thinking, creativity, people management, emotional intelligence, service orientation, assessment and decision making, negotiations, and cognitive flexibility [65, 67].

It is noteworthy that the views of teachers and STEAM female professionals are similar on the issue of involving girls in STEAM education and increasing their interest in the field of Science. Their references emphasize the awareness of gender equality in education and nondiscriminatory treatment in the teaching of Sciences and Arts. Still, the results also revealed that some prejudices about girls and STEM might prevail, such as their purported lack of interest and enthusiasm in Science and that girls are generally less skilled and, therefore, less successful in technological challenges. These prejudices can become a self-fulfilling prophecy: boys can become more and girls less self-confident in STEM, driven by the self-perception of their competence and skills [72]. This phenomenon again highlights that families significantly impact the hopes and professional aspirations of children. In terms of negative impact, this is certainly more the case for girls since they tend to avoid activities that are intended for "really smart" children only ([73], p. 389). Türkiye's focus group results showed that there are still schools struggling with girls' school dropout problems due to early marriage or family pressure. Therefore, in the last years, the government and other organizations have carried out many projects in Türkiye for the elimination of STEM and social gender-based inequalities through approaches that support collaboration among students, use appropriate role models, etc. [74]. The apparent intention is to influence children's interests positively and help them find their path in the world, remaining resilient toward gender-based prejudice. However, intentions need to find a practical deployment, and there is still a pronounced need to organize more joint-up activities, such as involving children, parents, and the broader STEM community, including businesses and academia [55, 56, 64]. This will allow parents and children alike to discover the excitement and the practical implementations of STEAM learning [75].

Finally, data in five countries (except Lithuania) show that parents do not have much awareness about the importance of STEAM education. Parental awareness should also become the focus for government and other policymakers. All the more since the influence of parents on children's choice of STEM disciplines and on learning results has been highlighted by several studies [54, 55].

4. Conclusions

Considering the STEAM approach to be an innovative pedagogical approach in preschool and primary school education in the postmodern era, exploring stakeholders' perceptions and expectations offers valuable insights to educational policymakers. Our research highlighted similarities and differences between the six countries

involved in the NGSS project. We compared data about teachers' perceptions of the benefits and obstacles in the implementation of the STEAM approach and their training needs; we also compared data focusing on teachers', STEM and Arts professionals' and parents' perceptions of the value of the STEAM approach, and the role of STEAM in increasing the participation of young girls and disadvantaged students in STEM.

The results have shown the challenges teachers from six European countries face in their efforts to deploy a STEM and/or a STEAM approach in the classroom; this included both actual challenges they had come across and potential issues they thought may impact teachers' work. Resources, training provisions, and support structures for teachers were identified as the building blocks of a rigorous, supportive environment for STEAM. The educational stakeholders (teachers, STEAM professionals, and parents) in most cases, did not have enough information (except the teachers from Lithuania and prospective teachers from Greece) or adequate tools and materials, or even adequate curriculum frames (except Greece) to properly implement the STEAM approach. Also, teachers and parents did not have a clear and deeper understanding of the potential benefits of the STEAM approach for children's development. But, a very positive aspect was that all teachers and STEAM professionals were enthusiastic about the approach and eager to learn more about STEAM education.

The perception of most interview subjects regarding gender discrimination was that there was no gender discrimination in the daily teaching activities or girls' access to general or Science education (except for Türkiye), at least to a declarative level. Still, there are raising questions that need to be answered about other factors or mechanisms involved in the determination of lower levels of female representation and participation in Science fields.

Society at large can draw benefits from well-run STEAM programs, in that they will not only raise the awareness of the importance of STEM among the public, but they can also equip society with the necessary resources, guidance, and mentorship structures [67, 76]. Beyond the arguments of international studies on the benefits of the STEAM approach in preschool and primary education, this study also highlighted teachers' understanding of these benefits, and especially their availability to overcome possible obstacles to implementation, including their desire for involvement in training for the STEAM approach.

Most importantly, this study offers a solid background for the next steps in developing good training programs, educational materials, and educational policy for implementing STEAM education at preschool and primary school levels.

This study has limitations, as the sample was not representative of each country. Thus, the results cannot offer a "state-of-the-art" picture of the STEAM approach implementation in the partner countries' preschool and primary school education. This objective would require complementary research, with larger samples from different groups of stakeholders (professional teachers, student teachers, parents, STEM professionals, artists, school managers, policymakers, etc.). However, the study brings up issues identified by international research in the field and shows that the six partner countries face similar problems with each other and the rest of the world.

Acknowledgements

The authors wish to express their appreciation to the project partners for their involvement in the accomplishment of the focus-group interviews. The authors

would like to express acknowledgment and thanks to the European Commission, for funding the Next Generation Science Standards (NGSS) through the STEAM project [Agreement No. 2020-1-TR01-KA201-094463 2020 Erasmus+, Key Action 201, Strategic Partnerships for school education].

Conflict of interest

The authors declare no conflict of interest.

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Chapter 4

Local History in a Digital Environment: Creating an Online Course for Young Children

Anastasia Stamataki and Maria Ampartzaki

Abstract

Twenty-first century demands students with critical thinking, digital and other soft skills, and capable of self-directed and self-determined learning. This chapter presents an educational design project, which focused on the development of a history online course for children of pre-primary level and the first grades of primary school, based on the constructivist paradigm of learning. Educational design research was carried out to explore how young children can respond to the demands of a contemporary online course, pursue the online course with growing confidence and independence, and earn history in a meaningful way, while developing twenty-first century skills at the same time. Data were collected by quantitative and qualitative methods and analysis showed that both pre-primary and primary school children responded remarkably well and managed to complete the online course with minimum parental support. They improved their knowledge and displayed critical thinking skills. Children showed no major difficulties in using the digital environment and expressed positive attitudes toward e-learning. The role of parents was also monitored and analyzed since it emerged as a critical factor in the successful completion of the course.

Keywords: local history, ICT, Learning Management System (LMS), inquiry-based learning, e-learning, early childhood education, primary education, educational design research

1. Introduction

It is common knowledge that the teaching method is critical for the student's learning achievements [1]. The teaching of history in the past evolved around memorizing dates, names, and event details that were detrimental to students' interest [2], as this is limited to the transmission and reception of information. Under these circumstances, students develop misunderstandings [3], display difficulties in learning [4], find it hard to retain information and develop a negative stance toward history lessons. The traditional lecture method does not appear to be an appropriate approach for contemporary students [5].

With reference to history in the early years, it remains a largely unexplored field. Although history belongs to the social sciences, which have a place in the early years' curriculum, research in this field remains scarce. History as a subject is considered appropriate for the early years [6] and early primary grades [7] as it offers opportunities for young children to explore and develop in the following dimensions:

- Knowledge about the past
- The values of past and present societies
- People's attitudes and behaviors
- Differences between past and present
- The change over time and the use of dates and time conventions
- The use of historical sources
- Historical reasoning
- Historical empathy
- Historical consciousness

Although there is still a need for further research that will examine the development of historical thinking, historical understanding, and historical consciousness [8], researchers believe in young children's potential to acquire historical knowledge and develop foundational skills for the future [6, 8–11].

2. Inquiry-based learning through ICT

Inquiry-based learning is a process in which children seek to find answers to questions raised either by themselves or by the adults. It is a process that appeals to children's natural and intrinsic curiosity [12]. Traditional teaching and learning methods [13, 14] can be replaced by inquiry-based approaches that actively involve students in the learning process, and the use of ICT can increase children's learning motivation [13–16].

Amid the demands of the contemporary era, the increasing use of technology in every aspect of life and education, and the demand of students to increase the use of technology in school [17] ICT use in the social sciences is increasing worldwide [13, 18–21 to name a few]. Despite this, persistence in the traditional means of lesson delivery is also noted by research (see, e.g., [22, 23]). Many educators or future educators hesitate to abandon the traditional approach to teaching history due to their technical deficiency [24, 25], because of disbelief, or because the change of approach demands advanced skills and longer preparation times [26, 27].

The digitization of information can open new possibilities in theoretical lessons, such as history, in the contemporary era. The internet allowed scholars and students

the retrieval of information from a variety of sources in a short amount of time [28, 29]. The use of digital libraries opens access to primary and secondary sources of information [26], which makes the development of individual exploration and personal interpretation easier [30, 31]. The development of study groups in social media enables collaboration, interactions, and exchanges among distant students, teachers, and organizations [32]. The role of virtual visits and simulations is equally important [32–34] for historical eras and landscapes that we would not be able to visualize otherwise. Visual data offered by simulations yield complex information that facilitates better understanding and spatial perception in children [34]. Rich cooperative learning environments allow students to learn collaboratively in spaces outside school [24], overcoming the restraints of space and time. The digitization, sharing, and publishing of research results contribute to the development of a new learning environment in which students help other students of diverse backgrounds to learn, revise and complement each other's knowledge by utilizing twenty-first century skills, such as creativity, communication, collaboration, critical thinking, decision making and empathy [35].

Quality and developmentally appropriate ICT software and applications can support active learning even in young students [36–43], once this satisfies some basic criteria, which are as follows: a) children's bodily and socio-emotional health must be protected [44–47] b) the nature of children's participation in using ICT must be active and exercise agency [38], c) the construction, features and the content of the digital material must be appropriate to children's age [43, 48], and d) the methodological ways in which educators integrate ICT in learning activities and everyday practices must adhere to constructivism, interactivity, and child-centered orientation [43, 45, 49–53].

To this effect, using ICT and inquiry in history lessons provoke children's interest [54, 55], makes learning enjoyable, and offers extra motives for developing historical knowledge and skills. In this aspect, ICT contributes to successful learning, the development of collaboration, and the removal of stereotypes, while it also allows children to exercise control over their learning [43]. It can also gain high learning value, as students develop their critical thinking, problem-solving, and cognitive skills in vigorous knowledge construction [37, 40].

Still, in the early years, children must deal with serious challenges when called to use primary or secondary resources (digital and non-digital) in the context of an inquiry. Due to the limitations imposed by their age they cannot locate, access, assess, and use resources without support, which might be proved detrimental to their learning [56].

3. 4C skills in history teaching and learning

Twenty-first century education strives to go beyond learning in a linear and predictable way, and it focuses on preparing learners to respond to a dynamic and unpredictable world [57]. The development of twenty-first century skills, such as critical thinking, creativity, collaboration, and communication skills (which are called the 4C skills, and are categorized as "soft" skills), aims at preparing students to cope with the swift changes in the contemporary job markets. The 4C skills contribute to the development of each student in a unique way, and they are all necessary for the internet era [58]. The development of soft skills and twenty-fist century skills in

early childhood and primary levels is highlighted as important for the development of a resilient, capable, and productive future workforce [59]. Moreover, care for the development of soft skills serves educational equity and is deemed as an imperative investment for the early years [60, 61].

These skills are also vital to learning history in the early and primary years and can be embedded in online learning environments, such as Learning Management Systems (LMSs), in a bid to prepare responsible and well-informed citizens.

Through the development of critical thinking, which is one of the essentials in learning history, students not only learn about events and facts, but they also learn how to inquire into, analyze, and interpret historical events. They learn to question and investigate, to cross-check different sources of information to discover multiple truths, realities, and interpretations. Moreover, they learn to make decisions and search for the answer in data they are not familiar with, apply different thinking modes, and consider different ideas, different kinds of evidence, and multiple aspects. These capacities are very important as the twenty-first century economy deals with a constantly evolving technological world that brings changes at every level of human civilization and demands from citizens to respond and adapt to unknown and fluid situations [62–64].

Creativity goes hand in hand with innovation and progress and is supported by flexible thinking. Students do not need to repeat routines constantly in the same manner. Instead, they can modify or shape new working methods, new ideas, or test new solutions in old cases [62, 64, 65]. Teachers ought to encourage and support thinking out of the box. Moreover, collaboration, that is, the capacity to work as a team member, is a basic life skill. Students learn to express their ideas, support equity in a group, deal with disagreements and have a fair share of the group achievements [62, 64].

In the contemporary digital world, which is based on communication—verbal or written, via email, social networks, etc., it is immensely important for students to learn how to transfer thoughts, ideas, questions, and solutions in ways that make them accessible to the others. Thus, students must learn how to articulate their thinking, in the best possible way, using contemporary multimedia technologies [62, 64, 66].

4. Educational design - a history online course for young children

4.1 The pedagogical and quality framework of the educational design

The development of our history course is an educational design that purports to address young children's introduction to historical thinking. The development paradigm we followed was the "instrumental" in which the design follows learning objectives [67]. We "identified" our "instructional goals," [68] which were to enable children:

- To understand what excavation is and how archeologists use it as a method of inquiry about the past.
- To realize that object features reveal information about people's lives in the past.

- To detect information about the Knossos palace's construction materials, the palace's rooms/sections, and their function.

- To compare the Knossos palace construction with contemporary housing; on the same track to compare the way of life in the Minoan and contemporary domestic environments.

- To learn about significant people and roles in the Minoan era and distinguish historical facts from fiction.

- To realize change, continuity, and connectivity in the Minoan past and the present of local people.

In addition, the design of the online history course took into account the pedagogical and quality framework proposed by the Vtt-Box project [69], which takes into consideration the quality benchmarks as set by the European Association of Distance Teaching Universities (EADTU), the E-xcellence quality label [70] and work carried out by Ossiannilsson, Williams, Camilleri, and Brown [71]. The main benchmarks that gave our course its distinctive character were: a) the provision of independent learning materials that enable and accommodate children's inquiries, b) stages of work in which interactivity with peers and materials gradually increases, c) collaborative tasks, and d) self-assessment tasks that promote children's independence in learning [72]. Moreover, the course included physical tasks that respond to young children's need for active learning and holistic, physical investigations in real-life environments [73].

4.2 The content of the history course

Learning about local history is an excellent pathway through which students can cross over from the more familiar to the more distant events of the general history. For this reason, local history seems to better suit the needs of young children. Thus, we created an online local history lesson in a Moodle environment, which is an open-source Learning Management System (LMS). This was comprised of three units. Each unit included a) information delivered by multimedia content, eBooks, and presentations, all with voice-over enhancement to accommodate students who were not fluent readers yet, and b) quizzes and knowledge games tailored to the needs and capabilities of young students. Moreover, the course contained open-ended tasks, which required students' physical collaboration and inquiries, purported to take place in various places of the physical environment. Finally, online communication between users (students, parents, and researchers) was enabled by forums created in the LMS space. Quick or urgent communication could also take place via phone or email. **Table 1** briefly presents the contents of this history course that was geared toward the Minoan era.

Thus, the course was set to be fully conducted as asynchronous, without direct teacher involvement (with the sole exception of the museum visit), giving students the freedom to a) form collaboration groups by themselves; b) choose the method of inquiry in each task (e.g., taking photographs, voice or video recordings, drawings, etc.); c) choose when and where the activities and learning will take place; d) decide about the order and length of study, and e) choose the modes of communication.

The course subject is the Minoan civilization, as it developed from 3000 to 1500 BC. The main palace of Knossos was excavated at the beginning of the twentieth century. More Minoan remnants are continually being discovered since then throughout the area of Crete. Three main units constitute this course, each introduced by clearly articulated learning targets and instructions on how parents can support work and handle the platform. The units contain the following:	
Unit 1	**The science of archaeology**
	The unit introduces children to the science of archaeology and the excavation missions. It contains one physical task of collaborative work in which students take part in a simulation of a Minoan house's excavation, a multimedia e-book, and a video introducing students to the concept of excavation and the discovery of the Minoan palace, three knowledge games, and two quizzes. Moreover, it prompts children to participate in a physical visit to the local archeological museum with activities about excavations and archeological findings from the Minoan era (this is organized by the course creators). At the end of the visit, children are asked to collaboratively create a poster about their visit.
Unit 2	**The Minoan Palace of Knossos**
	This unit introduces children to the structure of the palace, the palace rooms/sections, and their function. Through extension work, children are guided to discover the influence of the Minoan on contemporary Cretan life (e.g., influences on local architecture, names of people, streets, businesses, places, and the organization of the contemporary households). The unit contains presentations, videos with a 3D reconstruction of the Minoan palace, virtual tours through "Google Earth," two quizzes, and one physical task of collaborative inquiry.
Unit 3	**The Palace people**
	The unit focuses on the important people of the palace and the Minoan era. Moreover, children are called to distinguish historical fact from fiction because a variety of Minoan myths are popular in contemporary Crete and taught in schools. The unit contains multimedia presentations, videos, three quizzes and one digital, and open-ended task on the Minoan frescoes.
Other course components	The course also contains: • Glossary of the main vocabulary used in the course. • Reading list with books for further reading. • Extension work with outdoor activities. • Reference list. • Course evaluation questionnaire.
	The course is available through open educational resources commons at https://www.oercommons.org/courses/the-minoan-civilization-the-knossos-palace

Table 1.
The contents of the course: The Minoan civilization – The Knossos palace.

5. Educational design research on the effectiveness of the course

5.1 Research scope and research questions

The current research project falls under the category of educational design research [74, 75]. Thus, the scope was to explore, if young students (Kindergarten and children of the first two primary grades) can learn local history through an asynchronous online course with the minimum of adult support. In this context, the role of parents was monitored as pivotal to the development of children's independence in e-learning, and its impact had also been studied. Moreover, the development of a history online course that had the potential to cultivate twenty-first century skills,

such as critical thinking, collaboration, communication, and digital skills, as well as inquiry skills, was also a focus. Finally, we explored the way e-learning could meet the demands of contemporary history education, which is meaningful to young children.

5.2 Participants and process stages

The sample of this study was constituted of ten pre-primary (Kindergarten) and ten primary (Grade 1 and 2) children, who were chosen via convenient sampling. They all pursued our online course on local history, which lasted for an average of 3 weeks. The course was pursued in an asynchronous way, and without a teacher's support (with the sole exception of the museum visit). Instead, one parent per child (usually the mother) undertook the role of the supporter in the learning process. None of the children had previous experience with e-learning or had pursued an online course in the past, and only one of the parents had previously used Moodle, which was the chosen LMS. Both age groups (pre-primary and primary) were exposed to the same course content. In other words, there was no differentiation in the course content to match the different age groups.

The implementation process went into two stages:

1st stage: Getting participants familiar with the learning management system and the learning process.

A thorough introduction to the online course was organized prior to the course implementation. In this, parents were given a guided tour of the learning platform (LMS) and all the necessary details about the implementation process. The parental role was clearly defined and strictly restricted to allow children's initiative to play a major role. Parents had the opportunity to ask questions about the features of the platform, the amount of support they had to provide to the children, the time they could spend on each activity, or the course in general, and other relevant issues.

2nd stage: Course implementation.

Children started attending the course. This took place during their summer holiday, and it ensured that children did not receive any input from school on the course topic. They were encouraged to work in a variety of ways. Namely, they could study the platform materials independently, or in small groups with their siblings or friends. Then, each child had to carry out activities that combined online and physical tasks. Online activities were implemented on the platform and results were directly logged in. The results of physical tasks had to be uploaded with the help of the parents.

5.3 Data collection

Children's knowledge of the subject was assessed before and after the course via an interview comprised of 10 questions. The second interview, which was carried out when the children had finished the course, included additional questions, that explored the children's general stance toward e-learning. Moreover, data about children's attitudes and learning practices were collected by observation. An observation checklist was filled in by the parents after each course unit. The principal researcher also carried out non-participant observations of selected children when working on

the course. Fifteen out of twenty children agreed to be observed at different times whilst working on the course. During observation, the researcher recorded data on the platform's ease of use, children's concentration span, and children's ability to collaborate and communicate with each other. There were also data on how frequently children sought parental help, at what point, and the level of parental intervention. Finally, statistical data on the use of the platform were drawn from the platform logs.

5.4 Data analysis

Quantitative data were subjected to non-parametric tests since they did not meet the conditions for parametric tests (the sample size was less than 40). The quest for statistical analysis was to show: a) if the pre- and post-test difference in learning results were because of the online course, and b) if there was a statistically significant difference in the performance means between preschool and primary school children.

Data from observations and children's interviews were subjected to qualitative analysis, which went through two stages: a) coding, and b) interpretation. In the coding stage, data were scanned for incidents that revealed children's satisfaction, dissatisfaction, difficulties, and attitudes toward online learning, as well as the degree and nature of parental support and/or intervention. A "codebook" thematic analysis approach was followed, in which codes were initially developed but the coding was also open to new entries forming a partly deductive and partly inductive process [76]. Coding was followed by an interpretation of incidents in accordance with the aforementioned dimensions (satisfaction/dissatisfaction/difficulties, attitudes, parental support/intervention) [76, 77]. The results from the qualitative analysis were compared to those from quantitative analysis to achieve data understanding in its entirety.

In other words, there was a triangulation of data in an effort to strengthen the validity and credibility of the analysis and to bring out different elements and information collected from different angles at different times [75]. More specifically, three types of triangulation were carried out: α) triangulation of method in which quantitative and qualitative data about the same situation were combined, b) observed triangulation, since observational data were collected by the researcher and parents, and c) triangulation of data collection procedures as different tools, such as interview, non-participant observation, platform logs, or parents' observational forms, were used for data collection in the same research procedure [78].

6. Results

6.1 Learning outcomes

Children's knowledge levels of local history before and after the study of the online course were compared in paired groups with a Wilcoxon matched pairs test. There was a statistically significant difference between the pre- and the post-test in both group ages (pre-primary and primary). Primary children increased slightly more their knowledge (M = 39.6) than pre-primary children (M = 36.8). The Wilcoxon difference of the two test scores from the dependent pre-primary population was −2812 with a p-value of 0.02 < 0.05, which means that the difference in children's knowledge was statistically significant and not random (Wilcoxon, N = 10, z = −2812, and p = 0.02 < 0.05). The Wilcoxon difference of the two test scores from the dependent primary population was −2805 with a p-value 0.02 < 0,05, which means that

the difference in children's knowledge was statistically significant as well (Wilcoxon, N = 10, z = −2805, and p = 0.02 < 0,05). Furthermore, the qualitative analysis showed that children's work in open-ended tasks was focused, in line with the learning intentions, and meaningful to the children due to the connections drawn by the tasks between past and present and with children's everyday life.

6.2 The Mann: Whitney U-test for the unrelated samples of scores by pre-primary and primary school children

The Mann–Whitney U-test on children's knowledge of local history showed that there was a difference between the performance of pre-primary and primary children (U = 42.00 with p value 0.579 > 0.05), which was not statistically significant. Both groups showed progress that did not seem to relate to their age, or level of skills (reading skills and digital skills, etc.). Thus, no statistically significant differences were observed between preschool and primary school students.

6.3 Indications from the qualitative analysis of observational data

The results of the observation process carried out by the researcher gave answers regarding: a) the usefulness and user-friendliness of the platform and children's satisfaction, b) the development of children's critical thinking, collaboration, communication, and creative skills (4C skills), and c) the role of the parents during the whole process. The above were confirmed by the observational data collected by the parents.

6.3.1 User-friendliness, satisfaction, and digital skills

Qualitative data showed that preschool children, who were not yet competent readers and writers, as well as children in the first grades of primary school, showed great easiness in using the Moodle platform and completed their online course according to schedule without support from a teacher. Children did not encounter any major difficulties in using the platform, the multimedia material, or the platform interface. Three preschool children from the total sample (10 pre-primary and 10 primary children) showed clumsiness in using the mouse, which affected the speed of navigation and browsing, however, that did not affect the overall learning process or limit children's attention span. Even so, disturbance of attention occurred only in cases of poor internet connection that caused disruptions in the online flow.

Moreover, the course allowed children to familiarize themselves with digital tools. The pre-primary children were mainly observed, and the ten primary children learned how files (documents and pictures) can be stored, uploaded, and shared with other users, or how to use search machines, voice search, and keywords. All the children were introduced to manipulated tools, such as Google Earth, 3D browsing, pictorial material, and voice recordings, and played several digital games, such as quizzes, memory games, matching, and multiple-choice games, among others.

It was shown that the collaborative learning model in combination with attractive digital elements, such as multimedia, pop-up screens, immediate feedback in activities, as well as the open-ended activities, initiated children's interest. All children referred to their satisfaction and 18 out of the 20 children also expressed their willingness to pursue more courses in an LMS. The communication tools and the opportunities for collaboration offered by the LMS contributed to the reduction of

the alienation feeling in the LMS environment. Moreover, they seemed to contribute to the development of a sense of belonging as children felt they were part of a class with common goals, interests, and activities.

The multimodal presentations, the multiple screens, and the interactive elements of the LMS learning objects made the course materials attractive to children and provoked sustained interest and attention. In general, no indications of fatigue or hyperactivity were observed after coursework on the computer or the tablet. Only two preschool children from the total sample showed tiredness and discomfort when their parents put pressure on them to progress at a fast pace contrary to the researcher's instructions.

6.3.2 Improving 4C skills

The Moodle features and capacities allowed the creation of an online course that offered opportunities for critical, creative, and collaborative learning in opposition to a traditional classroom lesson.

6.3.2.1 Critical thinking

A change in children's behavior was indicative of the development of their critical thinking skills. That is, the number of children asking questions focused on local history and examining all relevant evidence with curiosity increased. So, while in the first course unit children who asked questions were as many as those who did not, in the second and third units the percentage of children who had questions to ask increased to 65% and 80%, respectively. These numbers indicate that not only did children maintain their interest, but wished to delve into deeper and more critical inquiries as well.

The course was successful in helping children to connect the past with present and their everyday life. This connection was also the result of critical thinking. Fifteen out of the twenty learners seemed to grasp continuity; that is, to understand that there were historical elements in many aspects of contemporary life. Moreover, they were able to recognize those elements and recall historical information about them. Evidence of this was found in children's interviews and parents' observations.

The open-ended course tasks demanded that children carry out inquiries in the physical world, Internet, printed information, and books, or oral sources of information. Thus, children engaged with interviewing, observing, reading, processing, comparing, synthesizing, and finally, presenting data. All these processes were beneficial to the development of critical thinking skills. Moreover, children had to respond successfully to quizzes focusing on the distinction of the history from the mythological elements, and the fictional from the nonfictional narrative, which is also a demanding cognitive process and makes use of advanced critical thinking.

The course features that allowed children to freely form collaborative groups, or tailor the course study according to personal preferences and even choose the method of inquiry or data presentation also contributed to the development of critical thinking and the ability to exercise initiative.

6.3.2.2 Communication and collaboration

Observational data and children's work showed that the course offered children the opportunity to exercise communication and collaboration skills both in digital

devices and in physical tasks. Children's age did not hinder their collaborative efforts. In cases of mixed-age collaboration, older children were keen to support the younger, although this was not always necessary. Younger children were quick to understand the procedures and displayed a remarkable degree of maturity as members of the group. More specifically, children found it easy to form groups, take on responsibilities, discuss, or offer help and suggestions. They communicated effectively and shared fairly. For them it was an opportunity to spend time with their friends, so no rivalries were developed, and their work was remarkable.

An important feature of this course was the development of links with the social environment. Children did not work in isolation from their environment. To collect information, they had to come into contact with local agents, and other members of the society (e.g., archeologists, museum educators, historians, neighbors, and local residents, etc.). This gave them the opportunity to develop a sense of belonging to wider social groups. They also realized that there are different codes of communication according to age, professional roles, and the environment in which communication takes place.

6.3.2.3 Creativity

Inquiry-based learning provides students with many opportunities to work according to their personal style of learning in opposition to more traditional approaches in which all students are assigned the same type of work and are expected to produce the same outcomes. Moreover, in inquiry-based approaches to learning students come across and must pick up information from a variety of sources, beyond their school textbooks. They can exchange information from digital sources, from their physical and social environment, or from printed matters. They can also become creators when preparing collages and 3D works, etc., or take photos, sound, or video records of evidence and information to create a written piece of work. In this approach, every student finds space for free and creative expression according to their talents, personal style, and available resources. It is very important that this process is inclusive for all students. For example, young students who do not like or feel unable to draw and write, can create a video recording or a collage. Students who do not possess equipment, such as a digital camera or a printer, can find alternative solutions to present their work. Young students do not always need adults' support to write down their findings since they can make recordings through a variety of means (physical and digital).

Children's samples of work showed that their creativity thrived. They did not repeat themselves using always the same methodological approach, but they tried new ways of work. They experimented with digital means, collected data in a variety of ways, and used them to create original pieces of work. When, for example, children learned about the Minoan labyrinth, they retrieved information from the internet (with support from their parents), they carefully examined a labyrinth model at their local museum, and they created: a) maze drawings, b) a labyrinth with junk material, c) a table game in the shape of a maze, and d) a model of the Minoan labyrinth.

6.3.3 The role of parents

Distance learning for young children demands family support. In this project, we realized that parents faced a variety of difficulties in providing support to their children. They frequently called for help or the researcher's intervention to solve practical

issues, such as difficulties in using technology (e.g., difficulties in uploading files, lost passwords, or problems with Internet connection) and in helping their children to participate in group work or to organize a task. The researcher logged 17 incidents of this type; therefore, her role was to offer mainly technical support and reassurance to parents and children.

In children's first steps in the online course, parents provided the scaffolding facilitating their children's transfer from the adult-directed and adult-supported to the independent use of the platform. This is also confirmed in a study by Plowman, McPake, and Stephen [42]. Parents showed children how to upload their work on the platform, what each screen icon does, how they should sit in front of the computer screen, and how to organize the resources in their course tasks. Gradually, the children moved from one-course unit to the next more independently. Multimedia material was particularly important because it offered visual and audio information. Picture and sound were the two elements that allowed children's independent work. They enabled students to extract information and carry out the required tasks without much adult help.

Children's family type (nuclear, single-parent, divorced-parent, reconstructed, and family with many children) and parents' obligations seemed to affect the family's spare time and, consequently, the time the family could devote to participating in this course. At times, it was not children who made the choice of how much time they could spend on the course each day. This was rather dependent on the parents' schedule, fatigue, or mood. Parents' intention to engage with, collaborate, and support this project seemed to affect children's participation, especially in the case of divorced families. There was an instance in which the child's participation was put to a halt when the child had to stay with the other parent.

The parenting style and mother's personality seemed to play an important role too and affect the degree of children's dependency as well as their progress toward self-directed learning and autonomous work. The authoritative style of parenting seemed to be more effective in promoting children's independence, as opposed to the authoritarian.

7. Discussion

The present project brought up several issues. It showed that even young children of preschool age could be effectively engaged with inquiry-based learning in LMS environments, with parents' minimum guidance and support. This agrees with research [79, 80], which showed that preschool children can successfully use a personal computer with very little support and supervision from the adults.

Through their engagement with our online course, both pre-primary and primary children succeeded in increasing their knowledge and skills. The learning approach adopted together with the digital elements of the course (multimedia, learning objects, quizzes, and digital activities) enabled children to develop historical knowledge and skills and grasp concepts which are necessary for understanding their local history. The results of the current study could, therefore, extend the spectrum of previous studies on the educational potential of ICT and the way it supports learning in subjects, such as literacy, numeracy, and science. [48, 81–86].

Children were involved in learning activities with a positive attitude and declared their willingness to pursue similar courses. 80% of the children indicated that they prefer to have this course via digital means rather than with a teacher. These results

bear similarity with results from a study by Spires, Lee, Turner, and Johnson [17], which showed that children link the use of technology to enjoy learning and would like to see an increase in the use of ICT in school.

Our course was based on the principles of inquiry-based learning. Children's engagement with inquiry activities that were directly related to their life and interests and took place in a variety of environments (the digital, social, and physical environments), allowed the development of both knowledge and critical thinking skills. Thus, the results of this project can be added to those from other studies, which also showed that inquiry-based learning supports the development of knowledge and critical thinking [1, 87, 88], and ICT's role in active learning [32, 36, 37, 39, 40, 42, 43, 54, 55, 79, 89–92]. Moreover, our research results agree with the results from studies [93–96], which highlighted the importance of meaningful learning for children.

The course supported children's communication and social skills through tasks that required collaborative work and tasks which brought them into contact with members of the social environment (experts, such as an archeologist, neighbors, and family members) This social dimension of learning would have been difficult to develop through a more traditional approach to learning history in which the lesson proceeds through the mere presentation of information. A prosperous collaborative environment facilitates communication, mutual assistance, negotiation, knowledge integration, boosting learning results [97, 98]. It was this type of environment that our online course strove to develop by combining independent with collaborative tasks together with indoor and outdoor tasks.

Students in this course showed evidence of thinking "out of the box" and this was the result of the flexibility deriving from the open-ended tasks. Copy-paste tasks with historical content presented to students, followed by comprehension questions were systematically avoided in our course. Instead, learners were encouraged to pursue their own investigations, discuss puzzling elements and queries, and discover the remnants of history in their everyday life. This enabled children to bring their investigations down to their level, claim answers to their questions, and craft multimodal and meaningful pieces of work, which were linked to their own life, and interests. All work was deemed acceptable, regardless of the mode of expression (e.g., writing, drawing, constructions with junk materials, photographs, or videos, etc.) without considering one way of work as the most appropriate. This of course did not imply that misconceptions were approved, but rather that misreading and misconceptions were treated as chances to try new approaches out and multiple readings [62, 64].

The role of parents was substantial, and this agrees with other reports that bring up the critical role of the family in educational practices [99–101]. It is also confirmed by studies that show the degree to which the family environment and the general cultural framework define the use of ICT at home [102].

Twenty-first century students are in continuous interaction with technology, Internet, and social media; thus, they display little patience, or tolerance for theoretical presentations and get bored when learning relies solely on school textbooks. The use of ICT is integral to children's everyday life and continues to spread and shape new kinds of experiences. Teachers, therefore, ought to take this into account when designing learning activities. Children unavoidably transfer their experiences in their school life, affecting the way in which they learn, explore the world, and create using available resources. Moreover, the mediums and instruments they have access to also define what children can become capable of doing [103].

The fact that children experience difficulties in studying history, do not retain details and develop a negative stance toward the subject of history demands for

approaches alternative to rote learning and memorization [104, 105]. Our study suggests one such alternative way of studying history using the means of an LMS.

It also gives some first indications for the capacity of LMSs, and the perspectives opened to the training of young children on the use of digital resources available to historians and the teachers of history [30, 31]. Using LMSs in pre-primary and primary education can be successful under conditions. For this, educators need to be trained and become competent in using technology, choose, evaluate and use of appropriate digital resources and tools, and introduce and support their students in using them. A similar kind of training is necessary for parents, since their support is critical to the success of distance and home learning.

8. Conclusions- limitations

The development of inquiry skills as well as the twenty-first century skills is essential to a post-modern view of history teaching and learning. The post-modern history curriculum is an "inclusive curriculum" in which history teaching and learning acknowledge diversity. It includes inquiry into both the social and the personal experiences and alternative narratives from marginalized or minority groups. Understanding multi-perspectivity is the foundation of quality teaching and learning practices: "With a multi-perspectivity in perceiving history, the students will get more views to understand and to learn history from diverse angles that can be very useful in history learning." ([106] p. 203) Having succeeded in this, students could also be engaged in analysis and critique of what Brickley [107] defines as the overarching theories that construe and define our understanding and the articulation of historical narrative and explanation. Thus, history teaching and learning should be based on open-ended tasks and activities that promote flexibility and provide opportunities for students to "develop their own alternatives and insights." ([108], p. 251) The learning environment must support the development of inquiry, communication, and critical thinking skills that will enable students to examine diverse and conflicting views of the past [33, 56]. Besides, the inquiry-based approach as supported by instructional technology in this study is a "transformative" approach that empowers children, promotes independent learning and research, and counters the "deficit" discourses that distrust children's capacity to lead their own learning [109, 110]. At the same time, it enables children to individualize their learning process, maintaining the social dimension of learning through the promotion of peer collaboration [56, 111].

The small sample of the present study does not allow the generalization of the results and conclusions. A study of a greater scale is needed to yield a broader picture and lead toward safer conclusions. Future research should also consider studying a more diverse sample, composed of different learning and cultural profiles, children of special educational needs included.

Conflict of interest

The authors declare no conflict of interest.

DOI: http://dx.doi.org/10.5772/intechopen.106407

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Chapter 5

Postmodernist Ideas and Their Translation into a Critical Pedagogy for Young Children

John Eric Wilkinson

Abstract

Over the past 30 years, postmodernism has established a firm foothold in the Arts, Literature, Architecture, and Philosophy. However, in Education, the adoption of the postmodernist paradigm into teaching and learning in educational settings is still in its infancy, especially in early childhood education and care where many argue that the ideas of postmodernism are most needed. Academics and some administrators now acknowledge that the social consequences arising from the Age of Modernity are adversely affecting humanity. A clarion call has been sounded for a radical re-alignment of the curriculum and pedagogy for young children to re-shape their social attitudes and behaviour. This chapter claims that the education of children in their early years needs to be informed and reformed by postmodernist ideas. In a recent publication, it was argued that the focus of early childhood education and care be shifted from a central focus on 'the self' to one where children learn to be located in social contexts where the emphasis is on greater critical awareness, social responsibility and social justice. After briefly contextualizing postmodernism, the chapter explores how a critical pedagogy for young children might emerge.

Keywords: young children, education, post-modernism, pedagogy

1. Introduction

As the era of postmodernism gathers momentum, Education is facing a fundamental challenge, especially to all those involved in Early Childhood Education and Care (ECEC). The existing paradigm in ECEC which is mainly based on psychological theories of child development that have been dominant in ECEC in the liberal world for the past 60 years is now subject to deconstruction [1, 2]. Both the purpose and process of Education for young children are under critical scrutiny from socio-cultural theory which advocates a radical shift in the content and pedagogy in ECEC from one based on the 'self' of individualism rooted in liberal ideology to one based on social responsibility and social justice rooted in democratic principles. Postmodernism rejects the pursuit of the individualism which encourages individuals to fulfil private ends mainly through relationships regarded as instrumental. Instead, it seeks to respect individualistic identity and subjectivity both within, and responsive to, social contexts.

Recognition of the 'social' function of Education is not new. Dewey, an influential American educationalist, writing at the beginning of the last century, claimed that the social function of Education was *to help society survive by passing down the ways of the tribe* [3]. This functionalist perspective was reiterated by Parsons, who was also an influential American educationalist in the second half of the last century [4]. An important function of Education during the Age of Modernity was to assimilate children into the dominant cultural norms and hegemony of the society in which they lived. Postmodernism offers a radically different perspective. It requires that many cultural norms be challenged and contested especially when they reproduce and perpetuate subordination, discrimination, and compliance to traditional hegemonic mechanisms of authority.

Challenging the *status quo* in society was also a feature of the birth of Modernity which emerged in Europe in the eighteenth century and quickly spread through the English-speaking world. Scottish enlightenment philosophers such as Smith and Hulme [5] promoted a mode of thought challenging the existing *modus operandi* based on superstition and religious dogma. They maintained that a mode of thought based on rationality and scientific thinking was essential for societal and economic progress as it offered universal truth and certainty about the world. Such thinking, which initiated the Industrial Revolution in Western countries [6], has been omnipotent in shaping the form and purpose of Education in pursuit of individual prosperity and social progress. There is no doubt that many people in the Western world have benefitted economically and socially from the Age of Modernity though many aspects of traditional hegemony have remained intact.

Enlightenment thinking of the eighteenth century was also contained in the work of the Swiss philosopher, Rousseau who is now regarded as an iconic figure in the history of ECEC. He was unquestionably a highly influential exponent of child-centred educational theory [7]. In his book, 'Emile' [8], written in 1762, Rousseau took the view that the guiding principle of a child's education should be an understanding of the child's nature at each stage of development. This was in stark contrast to the prevailing thought in the eighteenth century based on religious dogma. Although Emile is not a blueprint for educating children *per se*, it had a profound influence on how to view children and childhood.

The emerging emphasis on the individual child during the Age of Modernity in Western countries was in sharp contrast to the prevailing thought in Eastern countries [9]. One Eastern tradition that was very influential (and still is) was Confucianism where the individual was located in a socially conservative context that was defined by role dominance. Everyone knew their place and behaved accordingly with deference practised by lower-status groups for generations. Criticism and challenges were severely discouraged and often punished. This is still the case in China. Postmodernist ideas regarding social justice will be strongly resisted.

Turning to more recent times in the West, as the world emerged from the devastation of WW2 some 80 years ago many countries were eager to embark on an ideological shift from one based on a rigidly conservative social order to one based on liberal principles where freedom of the individual was highly celebrated and cultivated. In the UK, successive governments during the 1960s initiated a significant programme of liberal reforms in Education as recommended by official reports such as the 'Plowden Report' [10], and Before five in Scotland [11]. These reports embraced child-centred education which was largely rooted in developmental psychological theory at that time. The work of the Swiss psychologist, Piaget was particularly influential. The curriculum and pedagogy in primary schools and pre-schools/classes were

to be located in individual learning and development based on activity and experience with play central to ECEC. The social construction of the 'developing child' flourished in the latter part of the twentieth century [12] and is still evident today in national curriculum guidelines [13]. It is the application of these ideas to the education of young children that is the focus of the challenge from postmodernism.

2. Postmodernism and the challenge to ECEC

The central ideas of postmodernism are not new. European philosophers have posthumously inspired contemporary thinkers such as the French philosopher Lyotard [14] to develop these ideas in recent times. It was the work of the German philosopher Nietzsche over 100 years ago that has informed contemporary post-modernist writers. He claimed that in the social world there are only interpretations and constructs of various individuals and groups. Facts and objective truths were Modernist concepts [1]. At the end of the nineteenth century, this social relativism was in stark contrast to the absolutism and truth of science. For example, whilst no one would dispute that a water molecule consists of two hydrogen atoms and one oxygen atom, the same thinking does not apply to social phenomena such as, for example, the existence of a deity. According to Nietzsche's ideas, a religious deity is a psycho-social concept which, if challenged, can generate aggression in certain people with deep convictions. Given the supremacy of scientific and logical thinking during the lifetime of Nietzsche, it is not surprising that Nietzsche's ideas were dismissed as the work of a lunatic.

In the middle of the twentieth century, the French philosopher and sociologist Foucault demonstrated how the exercise of inter-personal power using discourse can serve to perpetuate social divisions and inequality to sustain the dominant hegemony in any given society [15]. Foucault has focused our attention on how social differences are reproduced in the fields of gender, ethnicity, social class etc., and inspired writers on postmodernism to deconstruct and challenge existing social norms. Interest in the work of both Nietzsche and Foucault began to re-emerge in the latter part of the twentieth century and it is now widely accepted that both Nietzsche and Foucault are the founders of the postmodernist era. In contemporary times, Foucault's ideas on discourse and power relations are now being applied to ECEC [16] in several countries.

One may wonder, however, why the appreciation and acceptance of postmodernism in European countries have only emerged over the past 30 years in disparate fields of human endeavour such as the Arts, Architecture, Literature and Philosophy but only more recently in Education [17]. Given that Education is a valued public service, fundamental re-alignment largely depends on the champions for reform having the ear of government. It happened in the UK in the 1960s and Sweden in the late 1990s where the newly elected social democratic government 1995 instigated a root and branch reform of the Swedish education system, especially in ECEC [18].

At the end of the twentieth century, the dominant debate in ECEC was the issue of 'quality' in early years settings following the publication of the ground-breaking research findings on the long-term effects of Project Head Start in the US [19]. The research showed that a quality pre-school experience was essential for long-term positive outcomes. Based on modernist thinking, an instrument for assessing quality in ECEC was constructed in the US [20] to help raise the quality in early years settings. This inspired Dahlberg and others [12] to advocate an alternative vision of a quality environment for young children based on postmodernist ideas. It was revolutionary.

Around the same time, new developments in the sociology of childhood were beginning to emerge. These ideas offered an awakening of social theory's concern with childhood and underlined the importance of postmodernist ideas [21]. It was the work of Dahlberg et al, however, that inspired others to advocate the reform of ECEC based on postmodernist theory. In 2006, Robinson and Diaz, working in Australia, published a book on social justice in ECEC based on postmodernist and feminist post-structuralism offering a radically different approach to the education of young children [1].

This approach has emerged from postmodernist writers' deconstruction of the current theoretical basis of ECEC, a basis which has focused on the application of developmental psychology to educational practice since the 1960s. It regarded 'development' as a linear movement along a biologically driven sequence of stages and its notion of the decontextualized child [12]. Osgood has presented a succinct overview of the contemporary postmodernist approach to ECEC [1]. It is a clarion call to all those involved in ECEC to shift the basis of education in the early years from one largely based on learning *about* the world to one based on learning how to be a critically active agent in the pursuit of social change. Based on the work of Vygotsky on children's learning, the argument for this shift was also put forward over twenty years ago [22]. Drawing on socio-cultural psychology it was claimed that learning is a process of becoming increasingly effective in the world in which we live, a claim that is consistent with postmodernist theory.

This theory maintains that the dominant influences on shaping children's social attitudes and behaviour are socio-cultural. These influences are at work, often covertly, within the family, in ECEC institutions, schools and the wider society including various media and religious organisations. They work to shape children's identity and subjectivity from the day they are born and serve to normalize and label children within categories that result in subordination for some and in dominance for others. The theory presents an inspirational challenge to Education to dislodge such normalizing processes recognizing in so doing will not be an easy option as existing entrench attitudes and constructs in society will be threatened.

Learning about the world has been the cornerstone of Education in schools and colleges throughout the Age of Modernity. Undoubtedly many generations have benefitted from their time spent in educational institutions often driven by the promise of personal improvement [23]. However, it cannot be claimed universally throughout the modern world where many young people have learned to assimilate existing hegemonies and to accept a subordinate sometimes dehumanizing role [24]. Furthermore, the social attitudes and behaviour shown by many adults even with the experience of ECEC in their formative years have been shown to be wanton in relation to the deep-seated problems now facing the whole world [25]. Concern for such problems as expanding inequality and dehumanization is now the main driver for educators to find a way to a more humane and fairer social order.

The overarching purpose, therefore, of embracing postmodern theory is to generate a commitment to a better world in which social responsibility is a dominant hallmark. Education has a key role to play in social reconstruction by redefining the social attitudes that are transmitted to our children. The process of this challenging transformation begins in early childhood as it is during this stage of the human lifespan that young children can assimilate a commitment to social justice. It is well established that children are very receptive to learning when they are young [26]; it is a period in the human lifespan when they acquire foundational social attitudes that often prevail into adulthood. It is a significant challenge for postmodern educators to

help dislodge current norms in many countries and replace them with greater critical awareness, responsiveness, and a sense of responsibility. To do this not only requires a curriculum for children's learning in ECEC which is rooted in social attitudes and behaviour but also a pedagogy that is arranged to help teachers and others engage sensitively with children in critical discourse and example [27]. A curriculum founded on postmodernist theory should encompass the following themes:

- Awareness and reflection
- Social responsiveness
- Social responsibility
- Social justice

The postmodernist theory implies that these themes should intersect in a matrix arrangement with other aspects of learning in most national ECEC curriculum guidelines, which contrasts with the linear arrangement common in such guidelines [13, 28]. This arrangement requires a more socially engaged and critical pedagogy than at present. If the curriculum refers to the 'what' of children's learning, pedagogy refers to the 'how' children's learning experiences should be planned and organized. The extent to which these social learning themes are given overt priority in the pedagogy deployed in ECEC settings often depends on the culture and prevailing ideology in each country. For example, in Western liberal countries such as the UK, considerable importance has been given to supporting children's personal, social and emotional development [29]. However, in some Asian countries, such as Taiwan and Japan, socio-emotional learning in young children has traditionally been regarded as the responsibility of the family and not the kindergarten [30]. With the introduction of new curriculum guidelines in Taiwan, however, and the national ideological transformation now taking place in a liberal direction, kindergarten teachers are now expected to address such matters in a meaningful way as part of the daily routines of the kindergarten with a growing emphasis on play [28].

2.1 Awareness and reflection

Awareness is a complex concept. It has at least two levels in social contexts as well as mindful awareness of oneself [31]. The first is the level of observation/noticing in both social and physical environments [32]. The second higher-order level concerns our knowledge and understanding [33, 34] which many would argue is central to the education process. In childhood, awareness at level one often becomes habitual unless children encounter someone or something that attracts their particular attention. For example, young children can display an awareness of others who differ from the norm in each culture such as skin colour. If a child's curiosity gets triggered, she/he will stare continuously for a short time often embarrassing the person who is the focus of attention. An informed parent might then ask the child not to stare as it would be considered rude whilst some parents might try to explain the difference that the child finds curious thereby taking the child's awareness to level two.

Another example of awareness at level one is how children learn to differentiate between private and public spaces. For example, how do children learn to behave somewhat differently when eating at home compared with eating in a restaurant?

Again, an informed parent would offer the child an explanation at level two. A postmodernist approach to this learning would follow up the awareness with reflection such that the child understands that the consideration for 'others' is considered important.

2.2 Social responsiveness

This is also a complex issue as it often requires a response to social encounters which differ according to the context. Even from an early age, a child's response to a parent will normally be quite different from a response to a stranger or friend. To respond appropriately in each situation (parent, sibling, friend, teacher, or stranger), the child has first to be aware of 'the other' then decide if, or how, to respond overtly or covertly [35]. Most of the literature in this field focusses on children with some form of social disability such as autism [36]. However, it is relevant to all children as even so-called 'normal' children are constantly called upon to respond to others.

As with other social issues, learning how to respond to others is culturally loaded. How adults, both parents and teachers, help children to engage with others is important and will play a large part in children's responsiveness when they themselves become adults. A postmodernist approach would encourage not only children to be aware but to reflect critically on their social encounters and respond to others, especially when in need or difficulty. 'Passing-by on the other side of the road' would not be encouraged.

This level of responsiveness requires children to apply their socio-emotional learning in their response to others. *Socio-emotional learning is the process through which children and adults undertake and manage emotions, and achieve positive goals and show empathy for others, establish and maintain positive relationships and make responsible decisions* [37]. Not all countries have traditionally regarded such learning as the responsibility of the kindergarten stage, especially in some Asian countries where the family is a powerful social unit [30].

Yet another situation that requires a response is in learning to take turns in a context in which other children wish to participate, examples being in children's games [38] and the use of other equipment in the kindergarten. Here again, it is crucial that teachers and others help children to understand why this social skill of taking turns is important. Failure to do so allows selfish behaviour to become embedded in day-to-day social interactions.

Responsiveness in some children can also involve anti-social behaviour. During the first few weeks of arriving at a kindergarten, some children may respond to a perceived threat from another child by biting the other child. Helping the child to understand that such behaviour is unacceptable and requires the child to learn how to regulate their emotions. Involvement of the parents of a child displaying such behaviour is essential but requires sensitive social skills on the part of the teacher and childcare worker to address the problem [39].

Perhaps the most challenging aspect of helping children to learn appropriate social responsiveness, however, is to equip children with the skills and confidence to question the normalizing discourses that perpetuate social inequality [1]. How this is done is crucial as for some children there will be a clash between a critical perspective promoted in the kindergarten and the discourse prevalent in the family. In some Asian countries such as Taiwan and Japan, Confucianism is still highly influential [40]. The family is a very powerful social unit that both supports and controls its members sometimes to the detriment of individuals. Many parents expect their children to

obey them at all times [41]. In such situations, the transmission of traditional cultural norms can be a significant impediment to the ECEC teacher tying to instill in children a mindset that can challenge such norms, norms that extend well into adulthood, especially in matters concerning gender [42]. For example, in Taiwan, a married couple is expected to spend the first day of the Lunar New Year with the family of the husband/father and then the second or subsequent day with the family of the wife/mother. This traditional cultural practice only serves to reinforce the greater esteem given to males in such countries [41]. A child with an awareness of social justice issues would propose to her/his parents that visiting families at this time of the year be alternated.

2.3 Social responsibility

One of the first connections between ECEC and children's learning about responsibility was made in the evaluation studies of the effectiveness of Project Heard Start. The researchers investigated whether participation in high-quality ECEC centres in the US would lead to greater social responsibility in adulthood. In these studies, 'social responsibility' was regarded as having four aspects: involvement in crime; formation of new family linkages; relation with the family of origin; and other personal and social characteristics. Whilst this perspective on social responsibility is consistent with that associated with the Age of Modernity it is interesting to reflect on the finding that successful persons (in terms of social responsibility) take control of their own destinies whereas the less successful feel that control is out of their hands [19].

A more recent approach to social responsibility and resonant with postmodernist ideas was articulated by Wray-Lake and Syversten [43]. They claimed that social responsibility is founded in democratic relationships with others where moral principles of care and justice motivate certain civic actions, a position also supported by Moss [44] who maintains that ECEC institutions should be places of democratic political practice. Reflecting on the prevalence of social responsibility in our contemporary world, especially with reference to the current virus pandemic, raises serious concerns that Education as is practiced in many liberal countries is deeply flawed. For many citizens, especially in such countries, to refuse vaccination and refuse to observe social restrictions in their daily lives in the name of 'freedom of the individual' is a moral rejection of social responsibility. It is an acute political issue. Humans live in a social world that requires mutual responsibility, not selfish individualism. Clearly, educators involved in ECEC in many countries now need to reconsider the importance they attach to their current practice of helping children to learn how to be responsible people. It requires a fundamental mental 'reset' based on postmodernist ideas in which ECEC has a crucial role to play.

A powerful way of achieving this is to involve children in group activities in which all the participants are interdependently involved. A successful outcome for a particular activity requires each child to fulfil her/his obligations to all the others. It has been shown that awareness of such obligations can become conscious in the first years of a child's life as a moral issue [45].

2.4 Social justice

In a previous publication, I outlined the essential features of what it means to pursue social justice, particularly in ECEC [46]. Settings that consciously pursue social justice education in a positive way will constantly require the teachers and child-care staff to instill in children the need for fairness, respect and opportunity. In so doing, social justice education *aims to disrupt the normalizing discourses that*

constitute and perpetuate social inequalities in society and operate to privilege certain identities and marginalize others [1]. The authors outline what a kindergarten might do at the institutional level to promote a commitment to social justice. They claimed that social justice education is far more successful if a whole institutional approach is taken encompassing management committees, staff, children, and families regarding equity issues. This is a very demanding task for the managers of a kindergarten and requires a high level of negotiating skill such that children are well supported in cases of acute conflict which can flare up quite quickly. For example, based on my personal experience of spending time in kindergartens in liberal countries such as Scotland, it is quite common that when children arrive at their kindergarten, they can choose, if they wish, an outfit/costume to wear for the day that crosses the gender divide such as a boy choosing to be a princess. When a child who has made this choice returns home and casually informs his parents of his choice, the father, particularly if he is not well educated, could be seriously threatened, and extend his threat to the child's teacher with a display of anti-social behaviour.

An enlightened teacher (and the principal/headteacher) committed to social justice would anticipate such reactions and place considerable importance and time in generating policy statements for the kindergarten followed up with extensive communication and negotiation with all the families of the children involved. This institutional response applies to all the areas of inequality such as gender identity, ethnicity, socio-economic status to name but three. It also requires an enlightened pedagogy that operates in the day-to-day routines of the kindergarten. The effects of such a pedagogy using judicious children's literature were demonstrated in two preschools in Australia [47]. The findings of the research showed that the children involved learned greater respect for human diversity and differences.

3. Towards a critical pedagogy

In its broadest meaning, pedagogy addresses both the organization of the learning environment in terms of the layout and deployment of the available resources and the professional approach of the teachers/childcare workers in supporting children's learning. In present-day practice in kindergartens/nurseries, the pedagogy is very often play-based and informal. Children can move about the playroom choosing activities and contact with other children at will [16]. The teacher/childcare worker will spend short periods of time with individual children and whole class groups in a supportive role influencing children's learning in aspects of the defined curriculum.

A feature of a postmodernist pedagogy, however, is the priority given to children working together on various collaborative activities such as with 'buddies' or mentors and in both small and large groups. Central to such arrangements is the discourse that takes place during the activity. 'Circle time', which is often deployed in ECEC settings, is a particularly important opportunity for the teacher/childcare worker to illuminate social justice issues [48].

An example of such group activity that requires an interactive and reflective pedagogy is in the realm of Moving Image Education (MIE), which has been argued, enables us to search for new and unimagined pedagogies [49]. In MIE, the idea is to generate a short video on a topic democratically selected with the teacher and children. All the children would then search out visual images associated with the topic in magazines, picture books etc. The various inter-dependent roles in creating the video would be distributed by negotiation to the children involved such as the

script 'writers', the actors, the camera operators, the prop designers, the editors, the producer, the music selectors and the video director. The teacher's initial role would be to locate short films associated with the topic to show to the children and stimulate discussion and subsequent detailed planning. The value of such activity is in helping young children to learn about inter-dependency. The eventual production of the video depends on each child fulfilling her/his role in the production process.

A popular topic with children in ECEC is an imaginary journey to the moon [50]. The idea might seem complex for young children and beyond the normal pedagogic skills of teachers but with a suitably trained and skilled teacher it can be very effective in promoting children's awareness, reflection, responsiveness, and responsibility as all the roles in the production of the video are inter-dependent. It is a highly motivating activity, and the children can feel a sense of pride when the video is shown to their parents. It is also claimed that MIE offers an opportunity for the realignment of the power relationships in groups of learners and teachers with consequences for learner and teacher identity [49].

Another important pedagogical practice that is open to a postmodernist approach is in the use of storybooks both by reading storybooks with a group of children and in children making their own picture books. The selection of appropriate storybooks is crucial as is the approach to the story used by the teacher. Reading storybooks with young children can enhance their prosocial behaviour [51] and can provide the opportunity to illustrate and illuminate social justice issues. For example, in Taiwan, the government has produced a series of colourful picture books with brief narratives for teachers and children in ECEC settings to explore the cultures of the various aboriginal tribes in Taiwan. On reading the narrative with the children the teacher will then engage the children in critical reflection which might be followed up with a member of a tribe visiting the kindergarten to extend the storybook narrative and/or a visit to a local aboriginal museum.

Storybooks can also be used to let children identify with the characters (sometimes animals) in the story. A multitude of social situations can become the subject of stories, particularly, where powerful emotions of happiness and sadness are involved. Storybooks can also illustrate everyday situations where power is deployed to control others. The use of puppets is another pedagogic practice that has high motivational involvement for young children which improves moral responsiveness to others [52].

A particular activity popular in Taiwan is for individual children to generate their own personal picturebook consisting of the child's drawings, paintings, and pictures created over a period and clipped together. Each child will then, in turn, present her/his book to all their peers. By using a microphone each child will stand in front of the group to describe each page of her/his book and answer any queries/discussions that may arise from the other children. Again, it is highly motivating and a confidence booster for the children involved.

Role-play is also a popular pedagogic activity in ECEC settings where the children take turns to act a particular role. Here, again, how the teacher uses such situations is crucial. A postmodernist perspective would be for the teacher to activate children's awareness of the context of the role-play then to help children reflect followed by highlighting the responsibilities of the various roles.

Another opportunity for group activity is in the preparation of snacks and other foods such as soup for the children to partake at snack time. Children learn to cooperate in the planning and the subsequent procedures. Clearing up after such activities underlines the importance of children's social responsibility to others.

Essential to these pedagogic activities is the use and frequency of 'circle time' [48]. It is part of the daily routines of many ECEC settings though it has been found to be underdeveloped [53]. In a small group with the teacher and children sitting together in a circle, the teacher can raise key postmodernist ideas. Twice daily, there is an opportunity for children to share their recent experiences both inside the setting and in situations either at home or in the local area such as awareness of social events on the way to the kindergarten during the morning circle time or visits to places of interest with their family members. The teacher could then steer any discussion into a reflective mode by asking children what they found special about any event and/or what they found likeable/unlikeable. The afternoon circle time could focus on activities inside the setting. When appropriate, the teacher could explore social justice issues such as fairness and respect by asking children to share their views and feelings with everyone in the group in response to their experience of the activities available.

Once the children become confident to talk and discuss issues in circle time, a skilled teacher would be able to reflect on children's experience by adopting a more critical dialogue informed by the recent work on critical pedagogy [27]. Such dialogue would initially be based on the teacher asking children to reflect and to propose better ways of organizing their activities. However, in some countries particularly in Asia, being critical is not encouraged in the culture. It can often be taken as a threat. There is little awareness of the need to differentiate criticism of ideas *per se* from criticism of persons. As such, postmodernism in ECEC presents a challenge to aspects of deeply entrenched traditional cultural norms.

4. Involvement of parents as partners

The involvement of parents and other family members is vitally important if practices based on postmodernist ideas are to be successful [1]. Clearly, communication between the kindergarten and each child's parents is essential. But communication *per se* is not enough to establish a working partnership between the family and the kindergarten. First, it must be understood that a kindergarten is neither a school even though it may be located inside a school building nor an institution simply to help prepare children for the demands of formal elementary schooling. In the era of postmodernism, the kindergarten requires an active working relationship with parents, both as a stakeholder group, and individually as key persons in a child's life.

An important feature of this working relationship is the process of formulating the kindergarten's policies not only on such matters as anti-social behaviour and provision for children with special educational needs but also on the profound social justice issues of gender, ethnicity, socio-economic status, and sexual identity. This process requires highly skilled professionals who can negotiate with and navigate through diverse social attitudes which requires the professional functions of ECEC teachers and childcare workers to be revisited [54].

Regular communication between the ECEC setting and the parents is essential to minimize any potential confrontation as the teachers help to raise children's awareness and challenge entrenched social attitudes. This makes the political function of kindergartens explicit, though the exercise of that function should be done in a context of democratic negotiation [44]. Similarly, when a teacher provides feedback on each individual child to her/his parents, the feedback should be located in the

child's social and democratic context. Using 'tests' to assess each child's abilities is counter-productive.

5. A new professionalism for teachers in ECEC

From the above, it is evident that a pedagogy based on postmodernist ideas places considerable demands on the professionalism of ECEC teachers and childcare workers. Current practice for the education and training of professionals in ECEC is inadequate to give teachers and childcare workers the skills now required. The education of ECEC professionals needs to be reconceptualised in the era of postmodernism [55]. Current constructions of professionalism leave few opportunities for ECEC teachers and others to engage in meaningful critiques of the *status quo* [56]. To engage in such activity, postmodernist ECEC teachers and childcare workers need a thorough understanding of and commitment to postmodernist theory. This requires ECEC professionals to act with awareness and responsiveness both in themselves and with children such that children, even when young, become *active agents in the construction of their own subjectivity* [1] and become motivated to pursue social justice in their own lives [57].

In the postmodernist era, a new approach to the education of ECEC professionals is required. An example of a 1-year postgraduate course at Linkoping University in Sweden is transforming how ECEC professionals are educated [58]. Based on a postmodernist curriculum framework this course trains ECEC professionals to help young children become more aware of their social environment through group-based activities, stories, and critical dialogue in order to equip children with resistance to the often-subconscious transmission of normative constructs on diversity and difference. It is now time to provide post-qualifying courses for childcare workers like that in Sweden and reform the professional course for ECEC teachers to provide early childhood education with critically reflective practitioners. In due course, consideration should be given to making such courses statutory for leaders (principals and headteachers) of kindergartens and nurseries in both the public and private sectors [59]. In so doing, the era of postmodernism will flourish.

6. Conclusion

This chapter has argued that the era of postmodernism requires us, humans, to think and act in a more sophisticated way than hitherto. The basis of such thought and corresponding action can begin when children are young and are receptive to learning new ways of thinking. Whilst the Age of Modernity has taught many of us to be rational and think logically, the emerging postmodernism requires our cognition to be more socially connected and less concerned with the pursuit of self-centred goals to the detriment of others.

In the postmodernist era, the potential role of ECEC professionals requires a more substantial recognition than at present. A major transformation is necessary. First and foremost, such a transformation requires a critical mass of educators to embrace postmodernist ideas and then to persuade governments of the need to allocate resources to initiate change at the national level. ECEC educators can become the instigators of a new social order which, above all else, embraces obligatory concern for others' welfare, rights, fairness, and justice. Throughout the world, parents,

ECEC professionals and governments need to be persuaded that a transformation of how young children are educated to become global citizens should be a priority. This chapter has addressed how this can be achieved by adopting a more critical pedagogy in ECEC.

Acknowledgements

The author wishes to place on record his appreciation to Su Yu-ling, the chairperson of the Department of Early Childhood Education, University of Taipei, Taiwan for her personal support and encouragement and Wang Hsiu-Ying, the secretary of the same department, for her technical advice in the preparation of the manuscript.

Conflict of interest

The author declares no conflict of interest.

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Edited by Maria Ampartzaki and Michail Kalogiannakis

This book discusses innovative approaches that employ transformative elements (targets, methods, materials, ideas, etc.) in early childhood education. It embraces integrated approaches and conceptualizations, such as the concept of "edu-care," which signifies the inseparability of care and education. Further, it examines the implementation of the STEM and STEAM approaches at the microlevel of a classroom and at the country level to get a grasp of the degree of implementation and stakeholders' understanding. It also presents a well-documented attempt at the creation of "transformative" learning experiences for young children through an online course on local history. The book ends with some concluding remarks on the application of post-modernist ideas in early childhood education.

Published in London, UK

IntechOpen

ISBN 978-1-80355-950-6