A cross-cultural exploration of early childhood educators' attitudes and beliefs around the use of touchscreen technologies with children under three years of age.

Authors: Fotakopoulou, O., Hatzigianni, M., Dardanou, M., Unstad, T., and O'Connor, J.

Abstract

This paper will discuss the views and experiences of early childhood educators across three countries England, Norway and Greece in relation to the use of touchscreen technology with the youngest children in their settings. Building on previous research which explored parents' perspectives, this study now extends the investigation to early childhood educators who play a key role in children's learning and development. A detailed online survey was implemented across the three countries based on an ecological framework. Findings indicate that although there are some pertinent cultural differences, overall educators are generally confident when using technology for work/personal purposes but less so when integrating technology with very young children. Educators across all countries were not satisfied with their training and attention is needed in this field. A special focus on educators' reported teaching philosophy is also given. The study found that country of origin had a significant impact on views towards technology; with Norwegian educators reporting the most positive views towards using touchscreen technologies in educational settings with very young children. Finally, it is recommended that more collaboration in communicating with parents and understanding home usage of technology. Macrosystemic factors in each country could be explored in future research to contribute to a deeper interpretation of similarities and differences between countries and cultural contexts.

Key words

Early Childhood settings; touchscreen technology; teaching philosophy; children under three years, cross-cultural study, educators' attitudes and beliefs

Introduction

The ability of young children to use touchscreen devices (e.g., tablets; smartphones) from a very young age has led to a rapid increase in the ownership and use of these devices across the world (Holloway, Green and Stevenson 2015). Despite the updated recommendations from the American Academy of Pediatrics (2016) for very young children to limit their screen time to one hour per day and children under two years to only be engaged in interactive video calls, numerous studies still show young children and adolescents exceeding optimal screen time recommendations (Kucirkova, Littleton and Kyparissiadis, 2018). However, very young children's (under there years of age) engagement with digital devices in their early childhood settings has attracted minimal research attention. Examining early childhood educators' beliefs and attitudes around this use is imperative as this use is constantly growing and becomes a part of children's everyday lives. (Plowman 2014).

This paper aims to extend our knowledge in this field by reporting on the findings of an international online survey across three countries: England, Norway, and Greece. The survey explored the attitudes and beliefs of early years' educators around the use of touchscreen technology with children under three years of age. Even though the differences in use of technologies might differ greatly between the age groups of early childhood education, this study made a first attempt in explicating the variety of experiences in three diverse educational contexts aiming at shedding more light into this new phenomenon.

This study had three primary research questions:

1. What are the beliefs and practices of early childhood educators of the three countries around the use of touchscreen technologies with children from birth to 3 years of age?

2. Are there significant similarities and differences in their beliefs and practices around the use of touchscreen technologies with children from birth to 3 years of age between the three countries?

3. Is there a relationship between educators' teaching philosophy and their attitudes and beliefs towards technology across the three countries?

Literature review and social contexts

Research into the use of technology by children under three years of age is limited and the majority of studies focus on the home environment rather than early years' settings (see Gillen et al., 2018; O'Connor and Fotakopoulou 2016).

Early years educators effectively take over from parents and they are the ones who can potentially promote or prohibit children's use of technology. A plethora of studies with older children have explored teachers' integration of technology in their classroom and have identified external (e.g., lack of training and sufficient resources) and internal barriers (e.g., confidence) to such usage (Blackwell, Lauricella, and Wartella 2014; Ertmer, Ottenbreit-Leftwich, Sadik, Sendurur and Sendurur 2012). More recently Hatzigianni and Kalaitzidis (2018) focusing on children under three years of age in Australia, offered a new insight in the factors impacting integration of technology into Early Childhood Education by underlining the role of the teachers' pedagogical philosophy.

This cross-cultural study aimed at exploring educators' views by also investigating their teaching philosophy. A basic assumption of the study was that educators face numerous challenges in their everyday practice and effectively integrating technology (or not) is one of

these challenges that needs to be carefully considered and examined to assist them with their critical role. The following section briefly outlines the educational context in each of the participating countries in the study. Highlighting the social and policy factors under which early childhood educators' work, and providing a relevant context assist with the interpretation of the findings of this study.

The context of technology use by 0-3s in early years settings in the three countries

England, Norway and Greece have distinct policy and cultural contexts in relation to the use of technology in settings with young children. In England all Early Years settings and educators of children 0-5 are required to follow the *Early Years Foundation Stage Statutory Framework* (2017) which comprises seven areas of learning which are mainly taught through games and play. One of these areas, *Understanding the world,* stipulates that children should be given opportunities to explore and find out about technology and be able to select and 'use technology for particular purposes. Another area called *Expressive arts and design* requires that children are enabled to explore and play through 'activities in art, music, dance…and technology', although no specific guidance is given as to how this might be achieved in practice. Different settings tend to have their own policies on technology use and these vary considerably according to the profile of the management, staff, and locality. In the wider society and in common with the other countries in this study, there is much 'panic mongering' around young children's use of technology, with, for example, newspaper headlines claiming babies are becoming addicted to iPads (Ofcom, 2015).

Kindergartens (age of children 1-5 years old) in Norway got a newly revised framework plan in 2017 with clearer guidelines towards the use of technology during kindergarten years (Norwegian Directorate for Education and Training 2017). Technology/digital tools is now to be incorporated into every learning area, to enrich what children experience in each area. An

example of this learning area is "Nature, environment and technology" where technology is considered a natural addition to being outside in nature, giving the opportunity of using GPS in activities, looking at videos of flora and fauna while tracking animal prints along with children's digital documentation of their trips (Norwegian Directorate for education and training 2017). Since kindergarten is considered a part of the children's education (elementary education from ages 0-16), teachers in Norway are bound to follow the guidelines of the framework. However, the framework allows for a wide interpretation, so the educators may incorporate the guidelines, allowing for teaching autonomy. This has led to a number of different approaches to the use of digital tools in kindergartens, ranging from an adult-used documentation method to a child-centered use to enrich their learning experiences. These different approaches to the use of digital technologies are also supported by empirical research in Norway (Jacobsen, Kofoed and Loi 2016; Medietilsynet 2015). Nevertheless, the Norwegian framework clearly underlines children's active participation when using digital technologies as an important principle of the kindergarten practices.

Greece has not developed an inclusive system, where education and care are equally valued. Greece still maintains a divided system where childcare organisations (for children 0-3) are based on 'care' and 'kindergartens' (for children four to six) are under the competence of the Ministry of Education, are compulsory for children to attend and have a strong educational focus (Gregoriadis, Tsigilis, Grammatikopoulos and Kouli 2015; Rentzou 2017). Research related to technology with young children in Greece has mostly focused on kindergarten children (4-6), (see for example: Bratitsis, 2018, Hatzigianni, Gregoriadis, Karagiorgou, and Chatzigeorgiadou 2018). Currently, limited research has been completed with children under three and their use of technology (O'Connor, Fotakopoulou, Hatzigianni, and Fridberg 2019). The OECD report (Hooft Graafland 2018) on internet access for children from birth to 18 years states that Greece is behind other countries in relation to its internet access (e.g. compared to

Denmark or Finland: 8). The report underlines the need for more research (Hooft Graafland 2018, 41) with our younger children including a whole section on '*younger and more connected*' for children from birth to eight years of age.

Overall, the context of the three countries is quite different. It is evident that while England is facing an era of scepticism and concern, Norway appears more positive towards technological innovations whereas Greece is in a period of flux as important administrative and political issues around early childhood education have not yet been resolved.

Methodology

To identify the views and beliefs of early childhood educators across the three countries in relation to the use of touchscreen technology with very young children in their settings and explore the factors that influence their views a between-subjects design was adopted. A detailed online survey based on the work of Hatzigianni and Kalaitzidis' study (2018) was translated into the different languages, adapted to the different educational contexts and circulated via e-mail invitations and social media to Early Years educators in England, Norway and Greece. Ethics approval was obtained in each country and the online survey was anonymous.

Participants

A total of 273 early childhood educators working in early years settings with children under three years of age (not pre-schoolers) in England, Norway and Greece completed the online survey. The only criterion for inclusion was for educators to have at least some experience working with children of this specific age group. The majority of early childhood educators in the three countries were female (93.77%).

Table 1: Distribution of sample in the three countries

	England	Norway	Greece	Total

Number of respondents	68	122	83	273
% Female	100%	93.3%	88%	93.77%

Research tool

A thorough on-line survey was created with Qualtrics and consisted of three main parts following the Bronfenbrenner's (1979) ecological systems model. Bronfenbrenner's model was adapted for educators as represented Figure 1.
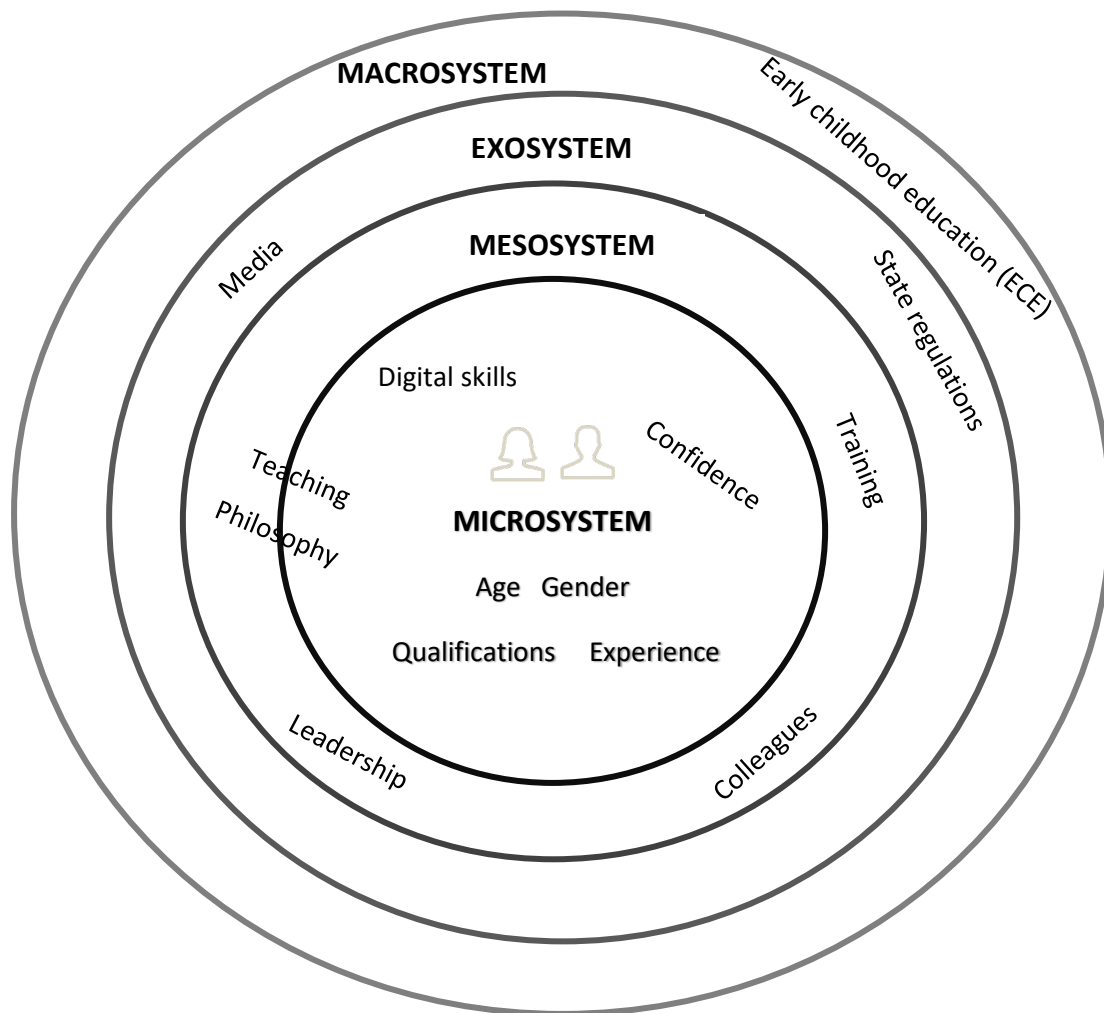
Figure 1: A visual representation of factors influencing educators' beliefs based on Bronfenbrenner's ecological model.

Educators are in the centre of the model and of the microsystem, the first inner circle (survey questions around demographics and personal characteristics of the participants). The second circle, 'the mesosystem' explored educators' digital skills and beliefs around technology. The questions for this second part had been adapted with permission from van Deursen, Helsper and Eynon (2014). The mesosystem is also related to workplace conditions, professional development, relationships with colleagues and leadership practices. Interrelationships between the mesosystem and the exosystem were explored by investigating teachers' pedagogical beliefs and philosophical stances, which are both personal and influenced by the sociocultural context. In this third part of the survey, questions around teachers' philosophical views were included. The 80 survey questions were adapted to be culturally relevant. Despite its richness and detail, the survey did not include any questions relevant to the macrosystem or chronosystem of the model and this is recognised as a limitation of the study.

Questions included a combination of multiple choice, Likert type items and some open ended questions to allow subjects more flexibility. The mean value of the internal consistency of the tool in three countries was found, a = 0.87 (Cronbach). Participants were invited via email to complete the survey. Information letters about the study and informed consents were also online for them to access and accept. The same survey with some adjustments could also be utilised to explore the views and beliefs of teachers who work with older children.

Procedure

Participants were invited via email to complete the survey. Information letters about the study and informed consents forms were also online for them to access and accept. The project had gained ethical approval from the Ethics Committees of all the Universities involved.

Results

Data were entered in IBM SPSS v24 and descriptive and inferential statistics were obtained (Please see Diagram 1 in the Appendix). In the first part of the on-line questionnaire personal characteristics including age, gender, qualifications, current position, years of experience and technology at their workplace were explored.

The age range of participants varied from 18 to 60 years with the majority of educators from the three countries being 31 to 40 year olds and 41 to 50 with a lower percentage being 23 to 30, 51-60 and 18-22 years of age (please see Table 2, Appendix). Additionally, the majority had zero to five years of experience with children 0-3 years of age, followed by 6 to 10, 16 to 20 and more than 20 years (Please see Table 3, Appendix). Furthermore, qualifications of educators were relatively high, especially in Norway and Greece where 75.4 % and 56.7% respectively reported a Bachelor degree. In Greece and England, a significant number (21.7 % and 11.8% respectively) held a postgraduate degree. The highest percentage of participants holding a professional qualification were in England.

Educators reported on the different forms of technology they use in their workplace on a weekly basis (see Tables 4a, 4b, 4c and 4d in the Appendix). Twenty-nine percent of educators in Greece use mobiles/ smartphones for one to two hours per week with only 16% in Norway and 5.9% in England respectively. Twenty-one percent of educators in England use their computers and laptops with children for one to two hours per week; whereas in Norway it is the 8.5% and

in Greece 17.6%. Furthermore, 13.3% in Greece use their computers and laptops for three to five hours and 10.6% in Norway for more than five hours. A relatively low percentage of educators in the three countries (8.4% in Greece, 6.4% in Norway and 7.4% in England) use whiteboards and similar robotics (8.4% in Greece, 15% in Norway and 7.4% in England).

Educators were also asked about the hours of technology training they had received in the last five years (Table 5, Appendix). A considerable percentage of participants (26.5% in England, 14.8% in Norway and 22.4% in Greece) had received no training at all and the majority had attended less than 20 hours of training. Overall, the evaluations of educators in relation to the training they have received were relatively low with the majority giving a neutral response (Table 6, Appendix).

Technology use and educators' confidence

Educators in England and Greece were asked whether they integrate technology in developmentally appropriate ways with infants/toddlers in their room. Half of the English educators responded positively and less than half of the Greek practitioners answered that they do not. There was no statistically significant relationship between the country and the integration of technology in developmentally appropriate ways. Educators in Norway were not asked this question as it was not ecologically valid for their education system and practice. Additionally, early years practitioners in Greece and England were asked whether they use technology to document children's learning. A different pattern of responses was collected from Greece and England; the majority of English educators responded that they used technology to document children's learning whereas the majority of educators in Greece responded that they do not. The relationship between country and use of technology was found statistically significant ($x2 = 6.36$, $p = .010$).

An analysis of variance revealed that educators' country of origin had an impact on their confidence to use technology for personal/work reasons (F^1 = 5.69, p^2 = 0.04) with educators in Greece reporting higher levels of confidence (M = 7.06) followed by the English (M = 7.00) and Norwegian educators (M = 5.96). Interestingly, the country was also proved to have a statistically significant impact on how confident the educators considered themselves with the use of technology with young children (F = 11.67, p = 0.00). In this instance, Norwegian educators reported significantly higher levels of confidence (M^3 = 7.26), with Greek (M = 6.06) and English (M = 5.56) educators following.

Linear regression analysis was used to test if the training hours significantly predicted participants' ratings of confidence in every participating country. The assumptions relating to multicollinearity were met; the independent variables (country and training hours) were not found highly correlated with each other. The results of the regression for England indicated that the predictor explained 6.9% of the variability in levels of confidence (Adjusted R^2 = .069); the overall association between the training hours and levels of confidence was not significant, F (1, 34) =3.582, p = .067). It was found that training hours did not significantly predict levels of confidence (β^4 = .309, p = .067). The results of the regression for Greece indicated that the predictor explained 22.1% of the variability in levels of confidence (Adjusted R^2 = .221); the overall association between the training hours and levels of confidence was significant, F (1, 48) = 14.890, p = .000). It was found that training hours predict significantly the levels of confidence (β = .487, p = .000) for the Greek educators. The results of the regression for

---

[1] The result of the ANOVA formula, the F-statistic (also called the F-ratio), allows for the analysis of multiple groups of data to determine the variability between samples and within samples (Dancey and Reidy 2011).

[2] To determine whether any of the differences between the means are statistically significant, we compared the p-value to our significance level (0.05) to assess the null hypothesis. If the p-value is less than or equal to the significance level, you reject the null hypothesis and conclude that not all of population means are equal and consequently you adopt the alternate hypothesis (Dancey and Reidy 2011).

[3] Means of samples of the groups are presented.

[4] The standardized beta coefficient compares the strength of the effect of each individual independent variable to the dependent variable (Freedman 2009).

Norway indicated that the predictor explained 4.3% of the variability in levels of confidence (Adjusted R^2 = .043); the overall association between the training hours and levels of confidence was significant, F (1, 117) = 6.345, p = .013). It was found that training hours did not significantly predict educators' levels of confidence (β = .227, p = .013). Overall, training did not appear to have a significant impact on educators' confidence across the three countries. This is a significant finding but also a logical one taking into account the lack of substantive training educators have received across all three countries and their low appreciation of it.

Educators' philosophy

Educators' philosophy, image of the child and related view on digital technology were explored via four statements (adapted from Arthur et al. 2012) which were rated on a five-point Likert scale (strongly agree to strongly disagree). Figure 2 presents the summary of differences in educators' philosophy for each country. A series of crosstabulations and a Kruskal-Wallis test were conducted to explore the relationship among the different pedagogical statements and the country of origin. The statistically significant impact of country was explored in detail for each statement to better understand the differentiation in beliefs for each country.

Young children are innocent and need our care and protection as much as possible at this age – starting using technology from such a young age might be harmful.
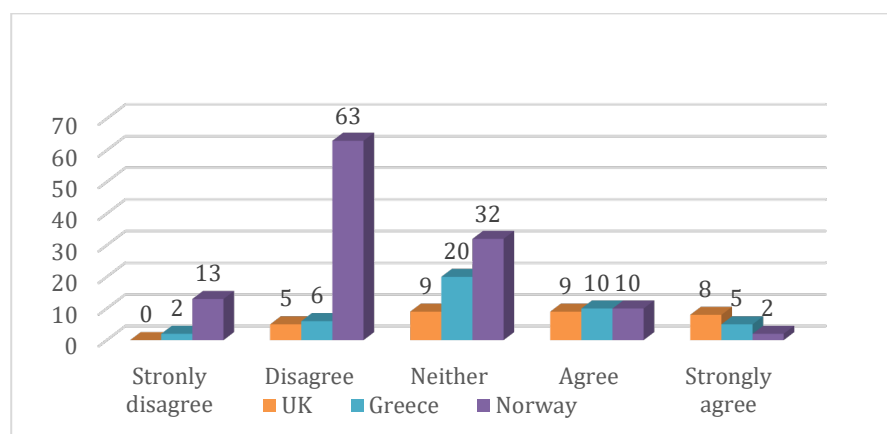
Young children are young explorers and need to build their confidence by taking initiatives and being creative – they can start using technology if it is integrated in their everyday routines/activities and it is developmentally appropriate.
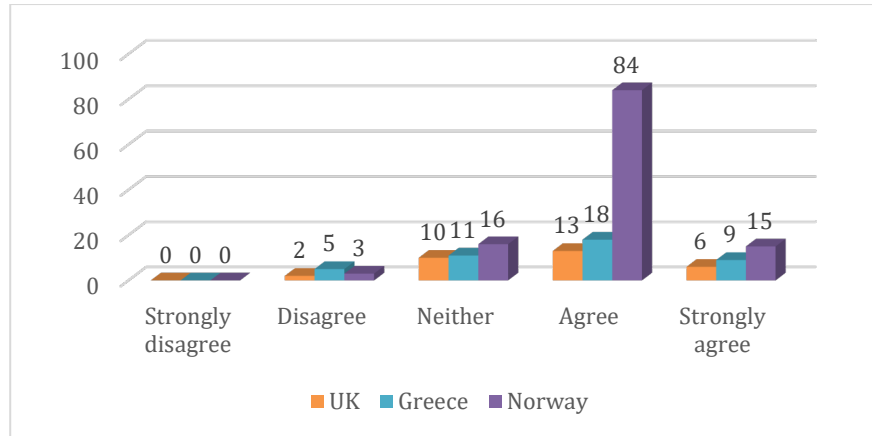
Young children have rights and practitioners should respect and support these rights. If children are interested in these technologies, practitioners should respect this and let the children use technology.
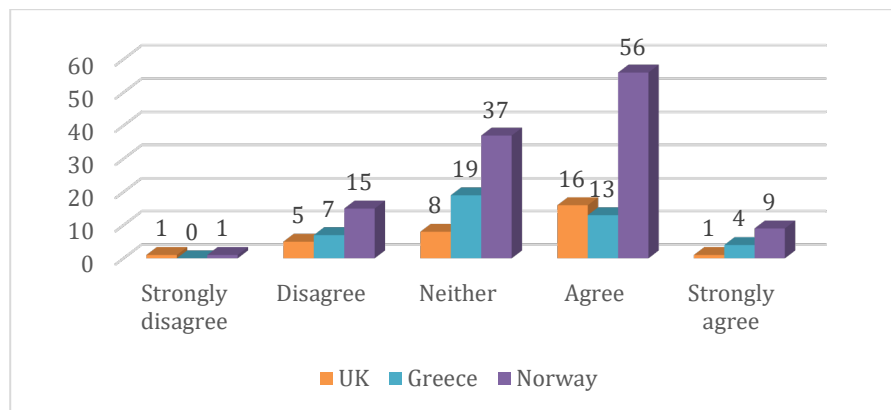
Young children grow up in a world infused with technology and they need to start using technology as early as possible so they progress with their education and stand a better chance for finding a better job in the future.
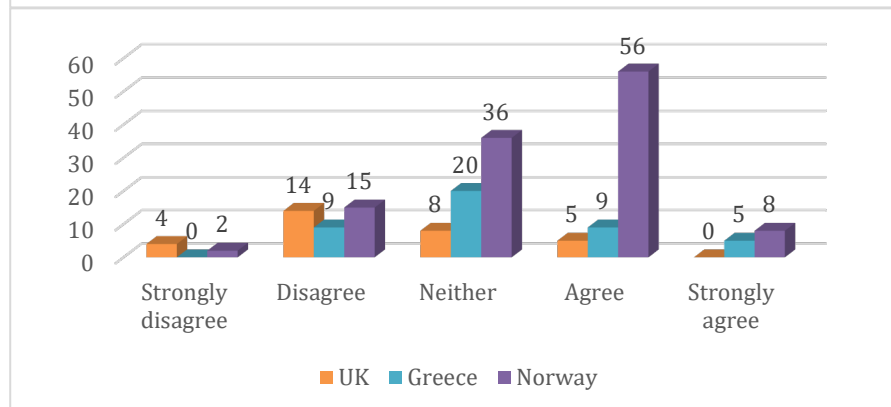
Figure 2: Educators' answers to four philosophical statements

Table 7 (see in the Appendix) shows the results of the Kruskal-Walis test revealing statistically significant results for two out of the four philosophical positions about innocence of children ($x2 = 46.382$, $p = .000$) and their world infused with technology ($x2 = 25.469$, $p = .000$) (the two opposite philosophical views) between the three countries.

Overall, educators from England appeared to be more cautious and sceptical about technology in comparison to their colleagues in Norway. Playing freely outside and traditional play were considered more advantageous than digital play. Looking at the rest of the statements, a larger number of Norwegian educators agreed with the view that children are young explorers, integration of developmentally appropriate technology and better chances for job opportunities in the future resonated with them. These two statements are more aligned with constructivism and social constructivism (Piaget; Vygotsky and Reggio Emilia theories). Greek educators seemed to be somewhere in the middle, closer to their English colleagues. Finally, almost the same number of educators in the three countries (just over half of them) agreed with the postmodern view around children's rights and the importance of respecting their choices.

A series of linear regression analyses were performed to estimate the relationship among the different pedagogical statements and educators' confidence with the use of technology with young children (Please see Table 8 below). A statistically significant impact of their confidence was found in relation to their belief that (a) children are innocent and need our care and protection (β=.299, p=.000), (b) children are young explorers and need to build their confidence (β=-.170, p=.019) and (d) children grow up in a world infused with technology and they need to start using technology as soon as possible (β=-.191, p=.008).

Table 8: Regression analyses predicting impact of confidence of educators with the use of technology with young children on educators' pedagogical approaches.

Pedagogical approaches	F	Sig	R Square	Standardized Coefficient Beta	Sig

a[5]	(1, 191) = 18.782	.000	.085	.299	.000
b[6]	(1,189) = 5.599	.019	.024	-.170	.019
c[7]	(1,189) = .638	.327	-.002	-.058	.425
d[8].	(1,188) = 7.142	.008	.031	-.191	.008

Furthermore, a multivariate regression was performed to estimate the relationship among the different pedagogical statements and hours of use of technology weekly. The results showed no statistically significant impact of the hours of use weekly and educators' pedagogical philosophy (Table 9).

Discussion and conclusion

This study provides useful cultural insights in what is happening in early childhood settings where children and educators spend a large part of their day. Consistent with previous studies (Hatzigianni and Kalaitzidis 2018; Kerckaert, Vanderlinde and van Braak 2015; Palaiologou 2016) educators' personal confidence with technology was high and not associated with their training. Educators' confidence was also statistically significantly associated with their cultural

---

[5] Young children are innocent and need our care and protection as much as possible at this age – starting using technology from such a young age might be harmful.

[6] Young children are young explorers and need to build their confidence by taking initiatives and be creative – they can start using technology if it is integrated in their everyday routines/activities and it is developmentally appropriate.

[7] c. Young children have rights and practitioners should respect and support these rights. If children are interested in these technologies practitioners should respect this and let the children use technology.

[8] Young children grow up in a world infused with technology and they need to start using technology as early as possible so they progress with their education and stand a better chance for finding a better job in the future.

and educational context (not applicable in the previous Australian study) and their philosophy (consistent with the Australian study).

Microsystemic (e.g., gender, age, experience, qualifications) and mesosystemic factors (e.g., use/type of devices, children's home use) did not appear statistically significant in influencing educators' attitudes and beliefs around the use of technology with very young children in all three countries. However, a significant relationship with a macrosystemic factor, the country of origin, and also a mesosystemic dimension, teachers' philosophy, were found to have an impact on educators' confidence and use of technology. Country and philosophy were more important than training or hours of technology usage. Norwegian educators had the, highest confidence in using technology with our youngest children and appeared more positive towards the integration of digital technologies in their settings.

Going deeper in the macrosystemic system and consistent with the contextual issues described for each country, Norwegian educators appeared less worried, more progressive in their educational views and not afraid to admit that technology use early on might open more job opportunities for children in the future. As the recently implemented Norwegian Framework for kindergartens (Norwegian Directorate for Education and Training 2017) underlines kindergartens' digital practices as a part of the everyday activities, Norwegian educators are obligated to follow the framework and integrate digital technology in their daily activities. On the other hand, technology is highly integrated in the Norwegian society, and therefore, in the Norwegian way of life as a whole (Myklebust and Talmo 2018). Both cultural factors like the focus on children's active participation and on their everyday experiences are particularly strong in the Scandinavian pedagogy. In addition, the availability of touchscreen technology offered to all children enrolled in kindergarten, may positively influence Norwegian educators' philosophy in relation to the use of touchscreen technology with the very young children.

Norwegian educators also reported the highest rates of confidence when integrating technology with very young children compared to the educators of the other two countries. It is evident that their positive stance towards technology (mesosystem) and the supportive framework (macrosystem) play a vital role in their confidence to experiment and embrace digital technologies early on. Norwegian educators showed more progressiveness than educators from the other two countries in relation to the implementation of technology in their everyday practices, as this is showed by recent research in Norway (Fjørtoft, Thun and Buvik 2019).

On the other hand, English educators who participated in this study were more concerned around the use of technology and trusted traditional modes of play more than digital play. They did not think of the future and issues of employability possibly because of the very young age of the children. Standing a better chance for finding a job in the future was more of a concern for Greek educators, but again not as high on their agenda as for their Norwegian colleagues, even though the unemployment rates in Greece are among the highest in Europe (Organisation for Economic Co-operation and Development [OECD], 2019). However, a limitation of this study is that the survey did not explore in depth macrosystemic or exosystemic factors (e.g., legislations, regulations, policies etc) for each country and this would be an important line of research for future studies.

Educators' philosophy is also worth further exploration as recommended by previous studies (Hatzigianni and Kalaitzidis 2018; Lynch and Redpath 2014; Lindahl and Folkesson 2012; House 2012). Overall, in this study constructivist approaches (statements two and four), appeared to be the most eminent views. Postmodern view (statement three), a strong belief in children's rights, was also more strongly evident than the 'romantic' view (statement one) which conceptualises children passive and always needing to be protected by adults. However, including a larger number of and more detailed theoretical questions would be beneficial in

future studies. More elaboration around educators' philosophy, pedagogical approaches and images of children would more efficiently clarify links with their confidence and views on the use of digital technology. Professional learning and development programs around integrating technology in everyday practice would also benefit from incorporating discussions around philosophical and pedagogical orientations (Underwood and Dillon 2011).

Conclusion - Implications

 This study contributes a cross-cultural perspective to the global debate around how best to integrate technology in settings for use with the youngest of children. The findings contribute to building stronger, equitable, ethical and inclusive communities where all children's rights are respected and supported and where educators feel empowered to introduce pedagogical transformations (e.g., the Norwegian context). Though a positive stance towards technology is now evident in different countries, macrosytemic factors should provide further support for educators to build their digital competences. Finally, educators' philosophy and their view on children is a significant factor influencing their pedagogy but also their technological practices. For educators, identifying and reflecting on their personal philosophies is a critical step towards a deeper understanding of their technological beliefs.

References

Ahearne Caroline, Sinead Dilworth, Rachel Rollings, et al. 2015. "Touch-screen technology usage in toddlers". In *Archives of Disease in Childhood*, 101, 181–183. doi: 10.1136/archdischild-2015-309278

Leonle Arthur, Bronwyn Beecher, Elizabeth Death et al. 2012. *Programming and Planning in Early Childhood Settings*, 5th Ed. Australia: Cencage Learning Australia.

Blackwell Courtney K., Alexis, R., Lauricella and Ellen Wartella. 2014. "Factors influencing digital technology use in early childhood education". In *Computers & Education*, 77, 82–90. doi: 10.1016/j.compedu.2014.04.013

Bronfenbrenner Urie, and Stephen J. Ceci. 1994. "Nature-nurture reconceptualized in developmental perspective: A bioecological model". In *Psychological Review*, 101(4), 568–586.

Bratitsis Tharrenos. 2018. "An Attempt for Critical Categorization of Android Applications Available for the Greek Kindergarten". In Auer, Michael and Thrasyvoulos Tsiatsos (Eds). *Interactive Mobile Communication Technologies and Learning*. Proceedings of the 11th IMCL Conference.

Dafermou Xara, Koulouri Pinelopi and Basagianni Eleftheria. 2006. *Preschool teacher guide*. Athens: Pedagogical Institute, Ministry of National Education and Religion.

Christine P. Dancey and John Reidy. 2011. *Statistics without maths for psychology*, 5th ed. Harlow: Prentice Hall.

Edwards Susan. 2013. "Digital play in the early years: a contextual response to the problem of integrating technologies and play-based pedagogies in the early childhood curriculum." In *European Early Childhood Education Research Journal*, 21(2), 199–212. doi:10.1080/1350293X.2013.789190

Ertmer Peggy, A., Anne T. Ottenbreit-Leftwich, Olgun Sadik, Emine Sendurur and Polat Sendurur. 2012. "Teacher beliefs and technology integration practices: A critical relationship". In *Computers & Education*, 59, 423–435. doi: 10.1016/j.compedu.2012.02.001

Fjørtoft Sylvi, Marte Thun and Marte Pettersen Buvik. 2019. *Monitor 2019. En deskriptiv kartlegging av digital tilstand i norske skoler og Barnehager.* [Monitor 2019. A descriptive

survey of the digital state in Norwegian schools and kindergartens]. Oslo:

Utdanningsdirektoratet. Available at:

https://www.udir.no/contentassets/92b2822fa64e4759b4372d67bcc8bc61/monitor-2019-sluttrapport-fra-sintef.pdf

Flewitt, Rosie. 2012. "Multimodal perspectives on early childhood literacies". In Larson, Joanne and Jackie Marsh (Eds.), *The SAGE handbook of early childhood literacy*. London, UK: SAGE.

Gillen, Julia, et al. 2018. "A Day in the Digital Lives of Children aged 0-3". Summary report by DigiLitEY ISCH COST Action IS140 Working Group 1 "Digital literacy in homes and communities". Available at: http://digilitey.eu/wp-content/uploads/2018/06/DigiLitEY-A-Day-in-the-Digital-Lives-FINAL.pdf

Gregoriadis, Athanasios, Nikolaos Tsigilis, Vasilis Grammatikopoulos, and Olga Kouli. 2016. "Comparing quality of childcare and kindergarten centres: The need for a strong and equal partnership in the Greek early childhood education system". In *Early Child Development and Care*, 186(7), 1142-1151. doi:10.1080/03004430.2015.1077820

Freedman. A., David. 2009. *Statistical models: Theory and practice.* Cambridge University Press.

Hatzigianni, Maria, Athanasios Gregoriadis, Ioanna Karagiorgou and Sofia Chatzigeorgiadou,.2018. "Using tablets in free play: The implementation of the digital play framework in Greece". *British Journal of Educational Technology*, 49(5), 928-942.

Hatzigianni, Maria, and Ioannis Kalaitzidis. 2018. "Early childhood educators' attitudes and beliefs around the use of touchscreen technologies by children under three years of age".

British Journal of Educational Technology, 49(5), 883-895.

http://dx.doi.org/10.1111/bjet.12649

Holloway, Donald J., Lelia Green and Kylie Stevenson. 2015. "Digitods: Toddlers, touch screens and Australian family life". *M/C Journal*, 18(5). Retrieved 23 August 2016 from

www.journal.media-culture.org.au/index.php/mcjournal/article/view/1024

Hooft, Graafland, Julie. 2018. "New technologies and 21st century children: Recent trends and outcomes". OECD Education Working Papers, No. 179, OECD Publishing, Paris.

http://dx.doi.org/10.1787/e071a505-en

House, Richard. 2012. "The inappropriateness of ICT in early childhood education: Arguments from philosophy, pedagogy and developmental psychology". In: Suggate S and Reese E (eds) *Contemporary Debates in Childhood Education and Development*. Routledge: New York, pp. 105–121.

Jacobsen, Helle, Trine Kofoed and Massimo Loi. 2016. *Barnehagemonitor 2015. Den digitale tilstanden i barnehagen.* [Kindergartenmonitor 2015. The digital status of kindergarten.] Oslo: Senter for IKT i Utdanningen.

Kucirkova, Natalia, Karen Littleton and Antonios Kyparissiadis. 2018. "The influence of children's gender and age on children's use of digital media at home". In *British Journal of Educational Technology,* 49(3), 545-559. DOI: 10.1111/bjet.12543

Lindahl, Mats G. and Anne-Mari Folkesson. 2012. "ICT in preschool: friend or foe? The significance of norms in a changing practice". In *International Journal of Early Years Education*, 20, 422–436. http://dx.doi.org/10.1080/09669760.2012.743876

Lynch, Julianne and Terri Redpath. 2014). "'Smart' Technologies in early years literacy education: A meta-narrative of paradigmatic tensions in iPad use in an Australian preparatory

classroom". In *Journal of Early Childhood Literacy*, 14(2), 147–174. doi: 10.1177/1468798412453150

Myklebust, Astrid and Vegard M. Talmo. 2018. *Teknologi og samfunn*. [Technology and society]. Oslo, Norway: Universitetsforlaget.

Nevski, Elyna and Andra Siibak. 2016. "The role of parents and parental mediation on 0–3-year olds' digital play with smart devices: Estonian parents' attitudes and practices". In *Early Years*, 36:3, 227-241, DOI: 10.1080/09575146.2016.1161601

Norwegian Directorate for Education and Training. 2017. *Framework plan for kindergartens: Contents and tasks*. Oslo: Norwegian Directorate for Education and Training. Retrieved 24 June 2019, Available here:https://www.udir.no/globalassets/filer/barnehage/rammeplan/framework-plan-for-kindergartens2-2017.pdf

Organisation for Economic Co-operation and Development [OECD]. 2019. *Unemployment Outlook: The Future of work*. Accessed from: https://www.oecd-ilibrary.org/employment/oecd-employment-outlook_19991266

O'Connor, Jane and Olga Fotakopoulou. 2016. "A threat to early childhood innocence or the future of learning? Parents' perspectives on the use of touchscreen technology by 0–3 year olds in the UK". In *Contemporary Issues in Early Childhood* 17(2). DOI: 10.1177/1463949116647290

O'Connor, Jane, Olga Fotakopoulou, Maria Hatzigianni and Marie Fridberg. 2019. 'Parents' perspectives on the use of touchscreen technology by 0-3 year olds in the UK, Sweden, Australia and Greece'. In Gray, Collette and Ioanna Palaiologou (Eds), *Early Learning in the Digital Age: Digital Pedagogy and Early Childhood*. London: SAGE. ISBN: 9781526463166

Ofcom. 2015. *Half of UK homes turn to tablets - in just five years*. Retrieved from:

https://www.ofcom.org.uk/about-ofcom/latest/media/media-releases/2015/five-years-of-tablets

Palaiologou, Ioanna. 2014. "Children under five and digital technologies: implications for early years pedagogy". In *European Early Childhood Education Research Journal*. Published on-line June 2014, doi: 10.1080/1350293X.2014.929876.

Plowman, Lydia. 2014. "Researching Young Children's Everyday Uses of Technology in the Family Home". In *Interacting with Computers*, 27(1), 36-46. https://doi.org/10.1093/iwc/iwu031

Radesky, Jenny S., Michael Silverstein, Barry Zuckerman and Dimitri A. Christakis. 2014. "Infant self-regulation and early childhood media exposure". In *Pediatrics*, 133(5), e1172–e1178. doi:10.1542/peds.2013-2367

Rentzou, Konstantina. 2017. "The Long Way towards Abandoning ECEC Dichotomy in Greece". In *Early Child Development and Care*. doi:10.1080/03004430.2017.1345898.

Rintakorpi, Kati, Lasse Lipponen, Jyrki Reunamo. 2014. "Documenting with parents and toddlers: a Finnish case study". In *Early years: an international journal of research and development*, 34(2), 188–197. https://doi.org/10.1080/09575146.2014.903233

Underwood, Jean, and Gayle Dillon. 2011. "Chasing dreams and recognising realities: teachers' responses to ICT. In Technology". In *Pedagogy and Education*, 20(3), 317-330. doi: 10.1080/1475939X.2011.610932

Van Deursen, Alexander J.A.M., Ellen J. Helsper and Rebecca Eynon. 2014. *In Measuring Digital Skills*. From Digital Skills to Tangible Outcomes project report. Available at: www.oii.ox.ac.uk/research/projects/?id=112

Appendices

Personal characteristics of educators including age, gender, qualifications, years of experience and technology at their workplace were explored with the use of descriptive statistics (Please see Tables 1, 2, 3. Descriptive statistics were utilised to explore practices in their workplace (Please Tables 4a, 4b, 4c, 4d).

•Their beliefs around the use of technology with young children and their beliefs in the three countries were explored:
•with descriptive statistics (Table 5, Table 6),
•crostabulations, (use of technology in developmentally appropriate ways, to document learning in the three countries),
•ANOVA (educators' confidence in the three countries),
•, Linear regression (training hours and confidence in the three counties).

Crostabulations and Kruskal-Wallis test explored the relationship between pedagogical statements and each country. Linear regressions were performed to explore the impact of confidence on their pedagogical approach.

Diagram 1. Flowchart showing all the statistical analyses performed to explore the research questions of the study

Table 2: Age of participants

Age groups	England	Norway	Greece
18-22	7.4 %	1.7%	1.2 %
23-30	11.8 %	29.8%	13.3 %
31-40	20.6 %	38%	32.5 %
41-50	23.5 %	24.8%	38.6 %
51-60	11.8 %	5%	4.8 %

Table 3: Years of experience with children 0-3 years old

Years	England	Norway	Greece
0-5	17.6%	50%	44.6 %
6-10	20.6%	24.6%	21.7%
11-15	10.3%		7.2%
16-20	7.4 %	25.4%	3.6%
More than 20	17.6		9.6 %

Table 4a: Use of Mobile/smartphone with children at your workplace

Hours per week	England	Norway	Greece
0 hours = no use	55.9 %	56%	31.3%
1-2	5.9%%	16%	28.9%
3-5	1.5%	12%	4.8%
more than 5	2.9%	16%	7.2%

Table 4b: Use of computers/laptops with children at your workplace

Hours per week	England	Norway	Greece
0 hours = no use	39.7%	46.8%	32.5%
1-2	17.6 %	8.5%	20.5%
3-5	0 %	4.3%	13.3%
more than 5	8.8 %	10.6%	6.0 %

Table 4c: Use of whiteboards with children at your workplace

Hours per week	England	Norway	Greece
0 hours = no use	52.9%	68.1%	61.4%
1-2	7.4 %	6.4%	8.4%
3-5	1.5%	2.1%	1.2 %
more than 5	4.4 %	17%	1.2 %

Table 4d: Use of robotics with children at your workplace

Hours per week	England	Norway	Greece
0 hours = no use	52.9%	84.2%	61.4%
1-2	7.4 %	15%	8.4%
3-5	1.5%		1.2 %
more than 5	4.4 %	12.5%	1.2 %

Table 5: Hours of technology training received in the last 5 years

	England	Norway	Greece	Total
None	18 (26.5)	18 (14.8)	19 (22.4)	55
Less than 20 hours	20 (29.4)	84 (68.9)	27 (31.8)	131
20-60 hours	3 (4.4)	15 (12.3)	9 (10.6)	27

60-100 hours	1 (1.5)	5 (4.1)	4 (4.7)	10
More than 100 hours	0	0	5 (5.9)	5
Total	42	122	64	228

Table 6: Satisfaction of educators with the training they have received

		country			
		England	Greece	Norway	Total
Overall, I am satisfied with the training I have received till now:	Not at all true of me	14	16	12	42
	Not very true of me	5	10	26	41
	Neither true nor untrue of me	9	28	35	72
	Mostly true of me	11	9	39	59
	Very true of me	2	1	6	9
Total		41	64	118	223

Table 7: Kruskal-Wallis test results on philosophical positions grouped by country

	Children are innocent	Children are young explorers	Children have rights	World infused with technology
Chi-Square	46.382	3.061	1.693	25.469
df	2	2	2	2
Asymp. Sig.	.000	.216	.429	.000