Evaluating numeracy apps in different cultural contexts

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In this symposium, we present three papers that evaluate numeracy apps designed for young children in three different regions of the world that have different curricula. In each paper, the apps are evaluated differently to determine what children are likely to learn and in what ways. By presenting our analyses, we are able to highlight how our evaluations are affected not just by the evaluation tools but also by our different socio-cultural contexts.

Introduction

In the last decade the use of digital tools to support young children to engage in learning has been both promoted and decried in general concerns about young children's (excessive) screen times (Neumann, 2015). Within these debates, research has suggested that teacher knowledge and competencies is important in determining whether digital tools "act as a tool in the learning process for the children" (Alvestad & Jernes, 2014, p. 3). If early childhood teachers lack education and experiences in using digital tools with young children, then commercial developers may gain more influence in educational practices than the curricula and policy documents intend (Alvestad & Jernes, 2014). The proliferation of digital apps, especially for young learners (Larkin, 2013), suggests that commercial developers believe that there is a strong market for producing educational mathematical apps for young children. In this symposium, we use different evaluation tools to consider the value of numeracy apps designed for specific regions, Norway, Catalonia and Moscow.

Evaluation tools for apps can provide opportunities for teachers to predict how they could influence pedagogical situations. Yet, there are presently few tools available to teachers (Handal, Campbell, Cavanagh & Petocz, 2016), particularly for early childhood settings (Papadakis, Kalogiannakis, & Zaranis, 2017). Of the evaluation tools that are available, many are not specific to mathematics (Handal et al., 2016) or do not include an awareness of cultural differences in curricula (see for example, Papadakis et al., 2017). Thus, we evaluated apps that focused on number understandings as much research in mathematics education for young children focusses on these understandings, including in studies about digital tools

(Rothschild & Williams, 2015) and all curricula made some reference to this mathematical knowledge.
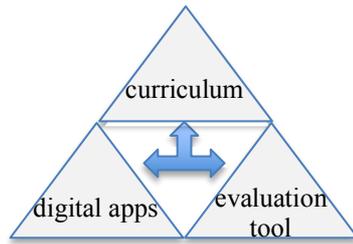

Figure 1: analysing the alignment of early childhood curricula with digital apps and evaluation tools

The results of our separate investigations allow us to reflect on the usefulness of evaluation tools in assessing the value of the app for supporting children's understandings about numeracy and how they were related to curricula goals (see Figure 1). These considerations indicate that the evaluation tools may not always support teachers to identify appropriate apps for supporting children's numeracy understandings and more flexibility is required to consider the cultural contexts reflected in the local curricula.

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Evaluating digital apps and games for improving numeracy understandings

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The goal of this presentation is to determine the features needed to evaluate digital games which could improve mathematical learning in multilingual kindergartens. Several digital apps or games about numeracy for young children are evaluated. The evaluation tool used is based on socio-cultural theory and drew on the ideas of Huynh (2015). The criteria in this evaluation are analysed to determine whether the evaluation tool would be useful for teachers to select the most suitable numeracy digital tools to use with children in early childhood centres. The evaluation highlights both political, related to the curriculum, and psycho-pedagogical directions in mathematical learning and teaching that were supported by the digital games. The main results suggest that the digital games or apps were likely to motivate children to engage with numeracy ideas. They were easy to manipulate and provided many opportunities to practice mathematical content. Most digital games could be played without any verbal language. However, some of the digital games lack support for individual differences in learning experiences about numeration. The implications of this research indicate that some digital games support young children to engage interactively and in collaboration with others, as well as to make links to real-world experiences, which could improve discussions about numeracy.

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Number concept acquisition in mathematical apps: Russian case

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The Russian Federation places a special emphasis on the system-forming role of mathematics in education as a whole. The effectiveness of mathematical concept formation in children in preschools is seen as directly connected to their subsequent academic performance. The formation of the number concept is a kind of preparatory stage for the development of elementary mathematical concepts.

Unlike traditional education, developmental education, based on the work of Vygotsky and his followers, occurs in the "zone of proximal development" (ZDP), that is, in the space that opens up new opportunities for learning the content through interaction with the adult. The developing methodology presupposes that number should be explored after mastering the system of relations of quantities. Each stage involves bringing the child to the ZDP for each subsequent stage and creating a need to establish a one-to-one correspondence.

Four popular apps in Russia, devoted to number concept formation, were analyzed based on 4 main criteria: dialogue (a potential of team work with an adult, where a mobile app acts as a means of organizing work); compliance with the specifics of the preschool age; methodology of education, on which the app is based; principle of continuity with school education.

Results showed that none of the applications presented meets the requirements of the developing methodology. Moreover, most of them do not provide continuity with school in terms of the traditional methodology. None of the applications are intended to stimulate the child's dialogue with the adult.

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Norwegian mathematical apps for young children

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Digital apps have become more available as pedagogical resources for teachers to use in early childhood education, with the costs for hardware decreasing and the range of digital apps increasing. In this paper, we evaluate two digital apps, DragonBox Number and Tella, that were developed for Norwegian children. We used the the Artifact-Centric Activity Theory (ACAT) framework for evaluating the apps (Ladel, Kortenkamp, Larkin & Etzold, 2018) and compared the results to the goals of the Norwegian curriculum for early childhood education. From this analysis, we reflect on the alignment between the curriculum the apps and the evaluation tools.

The evaluation of the two apps showed that the apps were based on similar understandings about developing number knowledge. However, it was only in DragonBox Numbers that children have a chance to take control over what they did in the app and then only to a limited degree. This finding raises questions about implementing the requirements in the curriculum for early childhood centres about using children's own interests and giving them possibilities to develop their own autonomy.

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