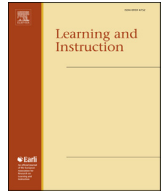




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Room quality and composition matters: Children's verbal and numeracy abilities in Australian early childhood settings

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ABSTRACT

Early literacy and numeracy competencies are an important foundation for successful school achievement. In this large-scale study data from over 2000 Australian children who attended formal early childhood education and care (ECEC) settings were analysed to identify predictors of these competencies. In addition to child and family characteristics, the quality and the composition of the attended ECEC rooms were included in hierarchic linear models. A significant amount of variance of both, verbal and numeracy competencies, was explained by child and family characteristics. In addition, room composition reflected by mean intelligence of the children in the rooms in which children participate and program quality were significant predictors. Children with lower in comparison to higher intelligence scores were affected more by being present in lower rather than higher average intelligence in the attended rooms. These and other findings are discussed in regard to the implications for children attending ECEC settings in Australia.

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1. Introduction

From an early age, children's emergent competencies are highly influenced by innate and environmental factors. Adults and other children who come into contact with a child thus influence child learning. It follows then, that both educators and the children who attend early childhood education and care (ECEC) settings contribute to the learning and development of children attending a given program. International research indicates that in addition to effects of ECEC program quality (e.g. [Sylva, Melhuish, Sammons, Siraj-Blatchford, & Taggart, 2008](#)), group composition in regard to average cognitive abilities of the children attending the same room, average family socio-economic status (SES) or the proportion of children with a migration background may influence an individual child's competencies (e.g., [Niklas, Schmiedeler, Pröstler, & Schneider, 2011](#); [Palardy, 2008](#); [Reid & Ready, 2013](#); [Weiland & Yoshikawa, 2014](#); [Westerbeek, 1999](#)).

However, these variables have seldom been analysed simultaneously while controlling for various child and family characteristics. In addition, few studies have focused on possible interactions

between child-level and room-level variables and for the most part, research was conducted in the US. This study analyses data from a large-scale Australian study with more than 2000 children attending over 200 ECEC settings and tests whether ECEC program quality and group composition are associated with children's early numeracy and verbal abilities when controlling for various child and family characteristics, and whether interactions between child- and room-level variables can be found.

1.1. Early verbal and numeracy abilities

Formal teaching and learning of literacy and mathematical competencies begin when children enter primary school. However, children acquire specific verbal and numeracy abilities long before school entry. Mastering early verbal and numeracy abilities is known to support further competency development across a range of school subjects, and to afford later success beyond the school years ([Duncan et al., 2007](#); [Geary, 2011](#)). For instance, kindergarten children's early vocabulary is an important predictor of later reading comprehension ([Joshi, 2005](#)). Likewise, children's counting and numeracy abilities predicted scores on arithmetic achievement tests in the first grade ([Niklas & Schneider, 2017](#)).

Factors found to influence the development of these abilities include the SES of the family ([Bradley & Corwyn, 2002](#)) and the home learning environment (e.g., [Niklas & Schneider, 2013, 2014](#)).

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For instance, [Tayler, Cloney, and Niklas \(2015\)](#) showed that children aged three to four years differed in their verbal and numeracy abilities dependent on the frequency of shared reading. Other cognitive abilities are also important for the development of both child verbal and numeracy competencies. In a study by [Schneider, Niklas, and Schmiedeler \(2014\)](#) early measures of intelligence at age 4 predicted academic success at the end of primary school. Further, the attendance at early childhood education and care (ECEC) programs and the quality of ECEC have an impact on children's early and later abilities (e.g. [Sylva et al., 2008](#)).

1.2. Quality in early childhood and school settings and child achievement

From a contextual perspective, child development occurs within the context of the family, the ECEC program (where applicable) and the broader social and economic community (see Bronfenbrenner's ecological theory; e.g., [Bronfenbrenner, 1979](#)). Accordingly, all characteristics of the ECEC room attended play a role in a child's learning. Examination of the room quality and group composition will thus lead to a better understanding of factors that contribute to child learning.

International research shows that attending formal ECEC settings may support young children's cognitive skills and learning ([Coley, Lombardi, Sims, & Votruba-Drzal, 2013](#); [Hamre, Hatfield, Pianta, & Jamil, 2014](#); [Niklas et al., 2011](#)). In addition to the longer total duration of ECEC attendance, room quality plays a major role. Here in particular, the quality of interactions between educators and children and educators' instructions within settings affect children's outcomes ([Cote et al., 2013](#); [Lehrl, Kluczniok, & Rossbach, 2016](#)). Consequently, in addition to the structural quality of a room (e.g. resources), the process quality in ECEC rooms appears to be important (e.g., educator-child interactions and educators' pedagogical skills). High process quality means positive and meaningful interactions between teachers and children, and clear teacher communication with children ([Ishimine, Tayler, & Thorpe, 2009](#)).

For instance, in a study by [Mashburn et al. \(2008\)](#) the overall room quality and in particular the quality of interactions between children and educators predicted both, children's behavioural and cognitive outcomes. Children's literacy ability was associated with the instructional support children receive in an ECEC setting ([Hamre et al., 2014](#)). Similarly, growth in mathematics skills in primary school was positively predicted by preschool quality, even when controlling for the quality of subsequent learning environments ([Lehrl et al., 2016](#)).

However, associations between preschool quality measures and children's cognitive outcomes within preschool program are often very small ([Weiland, Ulvestad, Sachs, & Yoshikawa, 2013](#)). In addition, different aspects of ECEC quality may influence different child outcomes. These associations are not always consistent and do not always align with theory ([Weiland et al., 2013](#)). For instance, [Blankson and Blair \(2016\)](#) showed that only children with greater intelligence profited from high classroom quality. Consequently, assessing several measures of ECEC quality and interactions with child characteristics is important.

1.3. Room composition in early childhood and school settings and child achievement

In the context of ECEC and school effectiveness research, contingency theory suggests that the importance of ECEC structures, resources, and practices to ECEC effectiveness depends on environmental conditions present in the ECEC setting (cf. [Palardy, 2008](#)). One such critical condition is the composition of the ECEC group attended by a child. Group composition in regard to average

cognitive abilities, average family SES or the proportion of children with a migration background in a room may influence children's learning through various mechanisms such as direct and indirect peer effects and resource allocation by educators.

In a study by [Palardy \(2008\)](#), students attending 'lower social class schools' learned at slower rates than students attending 'higher social class' schools, even after controlling for student and school characteristics (see also [Weiland & Yoshikawa, 2014](#)). [De Haan, Elbers, Hoofs, and Leseman \(2013\)](#) found that disadvantaged children in mixed preschool classrooms gained more in academic skills than children in targeted classrooms. Similarly, [Portes and Hao \(2004\)](#) showed that the proportion of children with the same ethnical background had an influence on academic achievement.

However, these results are not limited to the United States. [Westerbeek \(1999\)](#) showed for a large sample of primary and secondary students in the Netherlands that academic achievement was influenced by the average SES background of students in the classroom, the average performance of students in the classroom and the proportion of children with a migration background. [Walter and Stanat \(2008\)](#) found the same associations for German adolescents in the context of the PISA study. In both studies, a higher average SES background, greater average cognitive ability, and a lower proportion of children with a migration background in the attended room was associated with greater individual child outcomes.

Whereas most analyses of room composition have been conducted in the school context, several studies have focussed on ECEC settings (e.g., [Fram & Kim, 2012](#); [Mashburn, Justice, Downer, & Pianta, 2009](#); [Niklas et al., 2011](#); [Reid & Ready, 2013](#)). For instance, [Fram and Kim \(2012\)](#) showed that peer group composition contributed to the explanation of variance of vocabulary and mathematical skills of children aged from four to five years. In their study, Hispanic-dominant groups in comparison with black- or white-dominant groups were associated with lower individual child outcomes. Similarly, [Niklas et al. \(2011\)](#) found that a greater percentage of children with a migration background in an ECEC room was associated with lower individual vocabulary and phonological awareness scores in a German kindergarten.

[Mashburn et al. \(2009\)](#) found a positive association between peers' expressive language abilities and children's receptive language development in a large sample of 4-year olds. This association was also influenced by room quality. In fact, research indicates that interactions between different child- and room-level variables may play an important role for child outcomes (e.g. [Hochweber, Hosenfeld, & Klieme, 2014](#); [Niklas et al., 2011](#); [Rjosk, Richter, Hochweber, Lüdtke, & Stanat, 2015](#)). Children with a migration background, in particular, seem to be affected by classroom composition ([Niklas et al., 2011](#); [Rjosk et al., 2015](#)). These findings indicate that room quality and room composition should be analysed simultaneously and that these interactions need to be tested.

1.4. Research focus

In an Australian context, the association of child outcomes and the composition of the attended ECEC room has yet to be analysed. Further, most earlier studies have analysed the associations of child outcomes with either ECEC quality or with the average family SES of children attending the same ECEC setting or the ethnical composition of ECEC groups. Few studies have taken into account the average cognitive abilities of children attending the same ECEC setting. Studies are needed that consider various measures of ECEC quality and room composition simultaneously, while controlling for child characteristics and taking into account interactions between child- and room-level variables. Consequently, we decided to use

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