JOURNAL OF EDUCATIONAL RESEARCH & PRACTICE

Journal of Educational Research & Practice
2021, Volume 11, Issue 1, Pages 404–424
DOI: 10.5590/JERAP.2021.11.1.29

Original Research WALDEN UNIVERSITY

Differences in At-Risk Children's Preschool Assessment by Educators' Levels of Education

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Abstract

We determined that significant differences existed between assessment scores of at-risk children taught by assistant teachers with different levels of education using standardized assessments (Teaching Strategies GOLD [TSG] and Phonological Awareness Literacy Screening [PALS]). A 1-way MANOVA indicated that assistant teachers' level of education was statistically significant at p = .012. Archived pretest and posttest data were collected from TSG and PALS assessment scores of 142 at-risk Prekindergarten 4 children taught by 18 different Prekindergarten 4 lead and assistant teachers at a local Head Start site. We found that irrespective of teachers' levels of education, the role of assistant teachers should not be underestimated in at-risk children's learning process. We recommend future studies focus on the role of assistant teachers in the classroom to ascertain whether teacher-child interaction was a factor in this study.

Keywords: *lead teacher, assistant teacher, levels of education, at-risk, TSG, PALS*

Date Submitted: August 20, 2020 | **Date Published:** December 20, 2021

Recommended Citation

Olayinka-Bello, F. Z., & Brackin, D. (2021). Differences in at-risk children's preschool assessment by educators' levels of education. *Journal of Educational Research and Practice, 11*, 404–424. https://doi.org/10.5590/JERAP.2021.11.1.29

Introduction

Childcare is a part of everyday life in the United States. Over 35.9% of children under age 6 in the United States regularly attend one type of childcare (National Center for Education Statistics, 2018). These numbers help to illustrate the importance of early childhood (EC) learning; however, children's experiences vary in quality across programs and classrooms within center-based programs (Lin & Magnuson, 2018). The variation in the quality of services offered to children in early childhood education (ECE) programs has raised concern among researchers and policymakers. This has increased focus on improving ECE quality, driven by the aspiration that higher-quality ECE will better support children's early academic and social skills (Burchinal et al., 2016).

Teacher education is an important aspect of ECE. The National Institute of Early Education Research has included teachers' level of education (with a minimum of a bachelor's degree in EC or a related field) as one of 10 benchmarks for evaluating the yearly state of prekindergarten (Barnett et al., 2017). For efficient performance in early care settings, the National Association for the Education of Young Children (NAEYC) standards mandated that all lead teachers and assistant teachers in NAEYC-accredited childcare centers, including Head Start centers, acquired a baccalaureate degree by 2020 (NAEYC, Criterion 6.A.05-12, 2015). Moreover, The American Academy of Pediatrics (AAP) and American Public Health Association (APHA) have recommended a minimum of a bachelor's degree for EC educators (AAP & APHA, 2019). The AAP and APHA (2019) further suggested that at least 50% of all assistant teachers and teacher aides should have or be working on either a Child Development Associate (CDA) credential or an equivalent. To ensure a quality program, the state in which this study took place requires that all Prekindergarten 4 and 5 (Pre-K 4, Pre-K 5) lead teachers to have a state license in EC and a bachelor's degree in EC (Department of Public Instruction [DPI], 2017).

In addition to teacher qualifications, findings also indicated that environmental factors contribute to high-quality Pre-K programs to enhance a child's learning and development. Researchers have shown that cumulative environmental factors combined with fewer emergent literacy skills in kindergarten often lead to a slower degree of reading skills by children from low-income families in kindergarten or first grade in comparison to children from more high-income backgrounds (Cabell et al., 2013; Esmaeeli et al., 2019; Tayler et al., 2015). Children who do not meet the grade-level reading objectives by the end of first grade may not meet or exceed expectations through all elementary education levels (Cabell et al., 2013; Esmaeeli et al., 2019; Norwalk et al., 2012). Landry et al. (2017) found that the quality of most preschool childcare centers is neither high enough to meet the needs of children from high-risk backgrounds nor sufficient to prepare such children for school readiness. This may have a negative effect on assessments concerning school readiness performance scores and create a deficiency in learning as children transition to kindergarten (Lin & Magnuson, 2018), especially academically or socioemotionally at-risk children who have been described as having impediments in behavior and intellectual development in comparison to their peers from high-socioeconomic-status families (Bellows et al., 2017; Esmaeeli et al., 2019; Landry et al., 2017; Peeters & Sharmahd, 2014).

Risk and development go hand in hand. There is consistent agreement regarding the outcome of children from at-risk, low-income, or disadvantaged families in terms of cognitive and developmental delays, social-emotional development, and the exhibition of challenging behavior (Bellows et al., 2017; Coley et al., 2016; Esmaeeli et al., 2019; Landry et al., 2017; Lin & Magnuson, 2018). However, limited research has addressed whether teachers' levels of education meet the specific needs of at-risk children and whether the level of education and experience affects scores on standardized assessments. Through this study, we sought to determine whether differences in lead and assistant teachers' levels of education lead to differences in at-risk children's scores on standardized readiness assessments.

Examining Factors Involved in Better Outcomes for At-risk Children

Teacher education varies nationally. Data at the national level indicate that in childcare centers, 35% of EC teachers hold a bachelor's degree or higher, while 17% hold an associate's degree, 28% have some college credits, 18% hold a high school diploma or equivalent, and 1% have not completed high school (Whitebook et al., 2016). At licensed, home-based childcare centers in the United States, 15% of teachers hold a bachelor's degree or higher, 16% have an associate's degree, 34% have some college credits, 29% have a high school diploma, and 5% have not completed high school (Whitebook et al., 2016). At nonlicensed, home-based day care centers serving three or fewer children (unlisted), 15% of teachers hold a bachelor's degree or higher, 9% have an associate's degree, 24% have some college credits, 27% hold a high school diploma or equivalent, and 25% have not completed high school (Whitebook et al., 2016). The differences in teachers' levels of education may influence the quality of care offered to at-risk children and may subsequently affect efforts to meet the national preschool benchmarks set by The National Institute of Early Education Research (Barnett et al., 2017). The influence of the quality of care offered by teachers of varied levels of education may be especially apparent for at-risk children from low-income families, who need teachers with more instructional strategies to identify and focus on curriculum content and self-regulation, rather than just providing enriched learning environments and resources (Claire-Son et al., 2013; Manning et al., 2017).

Intervention programs have shown some positive effects in some settings. However, intervention programs offered in Head Start for at-risk preschoolers have often yielded mixed outcomes and have recorded few improvements in cognitive, literacy, and socioemotional skills required for school readiness (Burchinal et al., 2016). Landry et al. (2017) reported that in Head Start, a few small positive effects have been recorded in social and intellectual skills across prekindergarten, but children's abilities in relation to these skills have not persisted in first grade. Findings have shown that children exposed to better quality ECE programs tend to score higher on measures of numeracy, receptive vocabulary, and school readiness when compared to children exposed to lower quality ECE (Côté et al., 2013; Donoghue & Council on Early Childhood, 2017).

Role and Validity of TSG and PALS in At-Risk Children's Standardized Assessment

Tracking a child's progress is one way that programs address children's cognitive needs. Head Start is required to track preschoolers' progress by using the Teaching Strategy Gold (TSG) assessment for cognitive, language, physical, and social-emotional development; literacy; and content learning areas, including mathematics, science and technology, art, and social studies (TSG, n.d.). TSG is made up of 38 objectives, and programs may choose to screen children in all the areas or select areas that meet the specific needs of the program. The Phonological Awareness Literacy Screening (PALS) is required to measure children's capability in alphabet knowledge, name-writing, print and word awareness, rhyming, and nursery rhyme awareness (Invernizzi et al., 2004). PALS is a research-based screening, diagnostic, and progress monitoring tool, designed by the University of Virginia, to screen and identify children who are at risk of developing future reading difficulties (Invernizzi et al., 2004).

TSG and PALS assessments are criterion-referenced tests that measure children's scores or performance based on set benchmarks (Lodico et al., 2010). TSG and PALS have demonstrated reliability, as evident in the consistency of scores obtained by using the same instrument at different times with different sets of equivalent items (Center for Educational Measurement and Evaluation, 2011). Validity and reliability of TSG and PALS were supported by studies that included large samples (n = 10,963, n = 20,970 for TSG) and (n = 21,592 for PALS) of diverse children and teachers all across 48 states in the United States and the District of Columbia (Center for Educational Measurement and Evaluation, 2011; Huang & Konold, 2014; Lambert et al., 2014). PALS ratings were compared to the ratings of reliability and validity of other standardized instruments created before PALS, but which served similar purposes, through pilot testing between publication years 2000 and 2004. The comparison indicated that PALS Pre-K was significant and moderately high (Huang & Konold, 2014).

Levels of Teacher Education and Credentials in ECE Quality

Research findings are mixed about what really matters and contributes to at-risk preschoolers' high performance and outcomes. The success of the Perry program was also attributed to a low-class size and better pay, with teachers serving no more than eight highly at-risk children from low-income families at a time (High Scope Research Foundation, 2016). Tulsa Head Start's (2007) success was attributed to teachers who had a bachelor's degree in EC or child development (CD), were certified in EC, and were compensated with the pay of public-school teachers (as cited in Barnett, 2011; Office of Head Start, 2017). Testimonials to the success and high quality of the 1999 New Jersey Abbot Program were the use of teachers with EC or CD degrees and certified teachers and assistants for each class, with a maximum class size of 15. Teachers in these settings were qualified to implement a developmentally appropriate preschool curriculum in accordance with the New Jersey Department of Education Program Expectation Standards of Quality (as cited in Farrie & Weber, 2014).

Other Factors Responsible for High-Quality Child Outcomes

Not only teacher education in general but also the area and level of teacher education was a focus of the current research. Lack of knowledge about CD and its applicability may be challenging for teachers whose areas of specialization may not be ECE or related fields (Barnett et al., 2017; Totenhagen et al., 2016). Different levels of education among teachers in preschool settings may influence the quality of programs offered to children (Barnett et al., 2017; DPI, 2017; Office of Head Start, 2017). Well-qualified EC graduates can support, model, and mentor other teachers and/or children by using pedagogical knowledge (Sims & Waniganayake, 2015). Rather than relying on higher levels of education for teachers, ongoing professional development and the introduction of a coaching model approach should be considered to improve teacher pedagogy toward high performance related to children's outcomes (Gomez et al., 2015; Totenhagen et al., 2016). Falenchuk et al. (2017) found no evidence that teachers' levels of education matter when teaching preschoolers. Other researchers have proposed that high-quality child outcomes and performance evolve from teacher-child interaction (Early et al., 2017).

In the study state, only 27.1% of lead teachers have a bachelor's degree, out of which 14.4% have degrees in ECE, with 12.7% holding a bachelor's degree in other fields (DPI, 2017; Early Childhood Association, 2017). Only 8.2% of assistant teachers have a bachelor's degree, out of which 1.7% have degrees in ECE and 6.5% hold degrees in other disciplines (DPI, 2017; Early Childhood Association, 2017). Master's degrees in EC are held by 2.2% of lead teachers and 0.4% of assistant teachers (DPI, 2017; Early Childhood Association, 2017). State statistics have revealed that 22.5% of lead teachers have associate's degrees, out of which 18.6% are in EC; 3.9% of lead teachers and 2.8% of assistant teachers have associate's degrees in fields other than EC; 10% of assistant teachers have associate's degrees, with 7.2% being in EC; 30.9% of lead teachers and 47.6% of assistant teachers have some college credits; and 17.4% of lead teachers and 33.8% of assistant teachers have a high school diploma or less. In effect, large differences exist in the levels of education of lead and assistant teachers who teach Pre-K 4 across the nation and in the study state (Early Childhood Association, 2017; Whitebook et al., 2016).

Theoretical Foundation

The theoretical framework for this study was Bronfenbrenner's (1979) ecological systems theory of human development. The theory describes the importance of interrelated ecological levels, conceived of as nested systems, involved in human development. The microsystem is the setting within which an individual behaves at a given time, while the mesosystem constitutes the developmental niche of the individual within a given period of development. The chronosystem represents the place of time within the systems, as time cuts across all of the components of human development (Bronfenbrenner, 1979; Nasiopoulou et al., 2017). In this study, we examined the interaction of the child within the context of the microsystem, mesosystem, and chronosystem as it related to teacher-child interaction.

Nasiopoulou et al. (2017) described ecological theory from an interactive perspective in which a developing individual is influencing and is being influenced by the environment in continuous interaction. From this viewpoint, it is through interaction that prekindergarten teachers, as developing individuals, construct knowledge and values and acquire tools to incorporate learning into practice (Nasiopoulou et al., 2017). This theory informed the problem statement and research question in that it targeted the difference, if any, between teachers' levels of education and at-risk children's scores on standardized readiness assessments. The developing child in the microsystem interacts with the teacher located in the mesosystem to determine an outcome based on the quality of their interaction.

Research Question

The following quantitative research question guided this study: How do assessment scores differ among at-risk children who are taught by teachers with different levels of education and years of experience?

The null hypothesis was as follows: There is no significant difference among assessment scores when at-risk children are taught by teachers with different levels of education and years of experience.

The alternative hypothesis was as follows: There is a significant difference among assessment scores when at-risk children are taught by teachers with different levels of education and years of experience.

Methodology

Target Population

The target population was 142 Pre-K 4 at-risk children and 18 Pre-K 4 lead and assistant teachers in a Head Start program. There were nine classrooms at the research site with a ratio of 17 to 20 children to 2 teachers in each classroom. The study used alphanumeric codes to protect the identity of each child and numeric codes to protect the identity of the teachers. The data identifying teachers' levels of education were collected from archived teacher information in the Child Plus database at the local Head Start, while the archived TSG and PALS assessment scores of at-risk Pre-K 4 children were collected from the local Head Start site. The children's population at the study site was made up of 100% at-risk children, of whom 96% were African American, 1% mixed race, 2% unknown races, and 1% other races, with 52% female and 48% male (Head Start, 2017). The local Head Start served children from birth to 5 years of age, with 24% of participants consisting of 4-year-olds; the primary language was English for 99% of program participants (Head Start, 2017). To represent a population of at-risk children, scores from Pre-K 4 children from Head Start settings were used, as Head Start is a federally funded program specifically serving at-risk children from low-income or disadvantaged families (see Landry et al., 2017).

Independent and Dependent Variables

We compared 18 lead and assistant teachers' levels of education and years of experience (independent variables) and at-risk children's scores on standardized readiness assessments (dependent variables) to determine if any difference existed between their levels of education, years of experience, and at-risk Pre-K 4 children's performance on the TSG and PALS fall pretest and the TSG and PALS winter posttest data. Lead and assistant teachers' levels of education were placed in five categories while years of experience were placed in three categories. The TSG and PALS fall assessments were administered as pretests in November 2017. Pre-K 4 children fell below TSG expectations and did not meet the benchmark for PALS (Head Start, 2017). The winter TSG and PALS assessments were administered as posttests in the month of February 2018. Both tests were taken by Pre-K 4 at-risk children in a local Head Start located in a Midwestern state in the United States.

A one-way MANOVA was suitable to determine if any difference existed between the group levels of the independent variables that had two or more continuous dependent variables (see Finch, 2020).

Assumptions

A descriptive analysis of the scores was performed to determine the mean and standard deviation, which revealed the variability of the scores. To ensure precise and reliable data, we assumed that the children's archival data received from the local Head Start were accurate and consistent. It was also assumed that lead and assistant teachers were trained to enter TSG and PALS assessment scores appropriately into the Head Start database. Furthermore, it was assumed that lead and assistant teachers were trained to offer the assessment tests appropriately to at-risk children and that the test was offered under suitable conditions. These assumptions were paramount to ensure the data were reliable enough to produce an accurate result. Another assumption was that the information in the Child Plus database was accurate and up to date regarding lead and assistant teachers' levels of education, training, years of experience, and other information. The Child Plus database information is under stringent quality control and was managed and supervised by the compliance and quality assurance department. These assumptions were necessary due to the nature of the quantitative study and the dependence on external factors and factors that we could not control.

Data Collection, Screening, and Cleaning

The initial data collected included 163 (100%) Pre-K 4 children. After data cleaning and the screening process, 11 3-year-olds in a 4-year-old classroom were removed as PALS was created to assess only 4-year-old children (see Invernizzi et al., 2004). Subsequently, 10 Pre-K 4 children who may have had their pretest in a prior classroom and posttest in another classroom, as well as children with no posttest scores, were removed. These were removed based on incomplete data. The total number of individuals whose data were used for analysis was 142 (87.1%) at-risk Pre-K 4 children. Accessed data from the local Head Start computer-based archived database of TSG and PALS webpages were numerical and continuous in nature, and the data generated from teachers' levels of education were categorical. To preserve confidentiality, we saved data in a password-protected computer, and all data will be destroyed after 5 years.

External Validity

This study was not experimental, so we did not present an intervention to affect or improve the performance of the subjects. Due to the archival nature of the data, we did not have any interaction with the subjects, so interaction effects of selection that may occur while using the pretest materials during experimental treatment did not apply to this study (see Creswell, 2014). The specificity of variables for this study clearly identified teachers' levels of education as the independent variable and the dependent variable as standardized assessment scores of at-risk Pre-K 4 children from a local Head Start. There was no treatment involved in the study; therefore, the operational definition of treatment was not applicable. Because the data were archival, there was no prior or later treatment administered by us, so the results of this study may be generalized to a similar population to that being studied.

Internal Validity

Possible threats to internal validity may include history, which may be unexpected occurrences between the pretest and posttest, and may affect the dependent data (Lodico et al., 2010). This limits this study because we did not personally conduct the pre- and posttests. To ensure consistency, we performed data cleaning and compared the pretest and posttest of each child on both standardized tests. We did not administer the pretest, so this may have limited this study (see Lodico et al., 2010). Threats of instrumentation may occur if the test instrument is changed in between the pretest and posttest (Creswell, 2014). We checked the archived data, and there was no such occurrence. The issue of selection-maturation interaction may also have limited this study because of the archival nature of the data. Due to the archival nature of this study, these factors were beyond our control. The use of MANOVA synchronizes the scores to remove possible extraneous variables.

Construct Validity

Construct validity may involve searching for evidence to ascertain how an instrument accurately measures a nonobservable ability from the variables (Lodico et al., 2010). Creswell (2012) described construct validity as validating the inferences about the variables in the study. Threats to construct validity imply reasons why a researcher may be wrong in their inferences. This may be influenced by how the test is administered and the conditions surrounding the administration. Interpretation of findings was comparison based and not on a cause-and-effect basis.

Data Analysis

Using a MANOVA design for an archived data of 142 at-risk Pre-K 4 children on standardized readiness assessment, the TSG (n.d.) and PALS (Invernizzi et al., 2004), we expected that there would be a significant difference between assessment scores when at-risk children were taught by lead and assistant teachers with different levels of education and years of experience. With a focus on at-risk Pre-K 4 children and their respective 18 lead and assistant teachers, we collected the archived data of at-risk Pre-K 4 TSG and PALS reports from Fall 2017 and Winter 2018. We also collected archived teachers' information and their levels of education and experience, as shown in Table 1. It should be noted that all Pre-K 4 lead and assistant teachers at the local site received the same professional development and training, coaching, and mentoring but had varying levels of education and experience.

Table 1. *Teachers' Levels of Education and Years of Experience*

Categories	Teachers' levels of education	Number of teachers	Teachers' years of experience	Number of teachers
1	MS, MA, BS, BA in ECE, CD or a related field and licensed	5 lead teachers	0-5 years	5 lead and assistant teachers
2	MS, MA, BS, BA in an unrelated field	1 lead teacher 1 assistant teacher	5-10 years	8 lead and assistant teachers
3	Associate in ECE	2 assistant teachers	10 years and above	5 lead and assistant teachers
4	Associate in an unrelated field	3 assistant teachers		
5	CDA College credits High school diploma	1 assistant teacher 2 assistant teachers 3 assistant teachers		

Note. MS = Master of Science; MA = Master of Arts; BS = Bachelor of Science; BA = Bachelor of Arts; ECE = early childhood education; CD = child development; CDA = child development associate.

Assumptions for One-Way MANOVA

All the nine lead and nine assistant teachers' (100%) educational experience were analyzed in relation to at-risk Pre-K 4 children's PALS and TSG assessment scores. The study met Assumptions 1 to 3 of a one-way MANOVA design. Assumption 1: Two or more dependent variables should be measured at interval or ratio level, otherwise regarded as a continuous variable. Assumption 2: The independent variables should consist of two or more categorical independent groups. Assumption 3: The data must have independence of observations.

Assumption 4: There should be no univariate or multivariate outliers. The assumption was met for all the multivariate outliers but was not met for all the outcomes of a univariate outlier even when extreme data were removed. Researchers have shown that outliers that do not result from data entry error or measurement error but are genuine rare values and have no good cause to be rejected or regarded as invalid may be kept in a one-way MANOVA analysis (Finch, 2020; Laerd Statistics, 2015). On this basis, the univariate outliers were kept in the analysis. There were no multivariate outliers in the data as assessed by Mahalanobis distance ($p > .001$). The Mahalanobis recorded for the data was 7.81964, and the value was less than the critical value of 18.47 for four dependent variables, as presented in Table 2.

Table 2. *Mahalanobis Result for Multivariate Outliers and the Critical Values*

MAH 1	Predictor variable	Critical value
7.81954	4	18.47
7.14196	5	20.52
4.65188	6	22.46
4.54893	7	24.32
4.49520	8	26.13

Note. p >.001. MAH 1 = 7.81954 for four dependent variables. MAH = Mahalanobis.

Assumption 5: There needs to be multivariate normality. This assumption was met for results that indicated $p > .05$, while some of the assumptions were not met because $p < .05$. The Shapiro-Wilk test for normality with a sample of 160 participants indicated that the test was significant at $p > .05$, as presented in Table 3. Assumption 6: There must be no multicollinearity. Assumption 6 was not met as a result of the presence of multicollinearity as assessed by Pearson correlation and presented in Table 4.

Table 3. *Shapiro-Wilk for Normality*

		Kolmogorov-Smirnov			Shapiro-Wilk		
	Lead edu	Statistic	*df*	Sig	Statistic	*df*	Sig
PALS pre	1	.147	47	.012	.899	47	.001
	3	.202	16	.079	.897	16	.073
	5	.135	79	.001	.926	79	.000
PALS post	1	.172	47	.001	.930	47	.008
	3	.146	16	200*	.930	16	.243
	5	.113	79	.014	.952	79	.005
TSG pre	1	.184	47	.000	.827	47	.000
	3	.217	16	.043	.859	16	.018
	5	.112	79	.016	.976	79	.137

TSG post	1	.118	47	.098	.847	47	.000
	3	.180	16	.176	.894	16	.064
	5	.149	79	.000	.961	79	.016

* This is a lower bound of the true significance.
[a]Lilliefors significance correction.

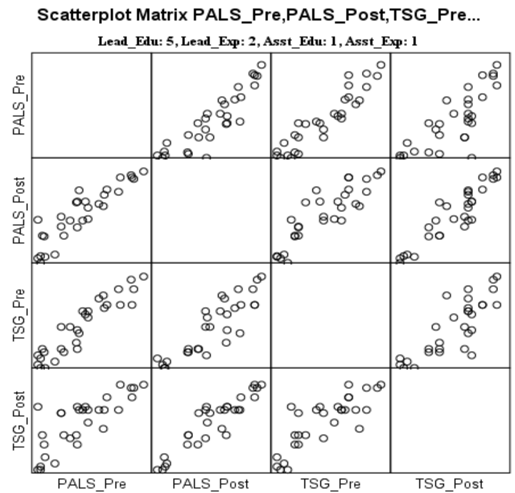
Table 4. *Pearson Correlation*

Pearson Correlation		PALS pre	PALS post	TSG pre	TSG post
PALS pre	Pearson correlation	1	.839**	.723**	.649**
	Sig (2-tailed)		.000	.000	.000
	N	142	142	142	142
PALS post	Pearson correlation	.839**	1	.655**	.751
	Sig (2-tailed)	.000		.000	.000
	N	142	142	142	142
TSG pre	Pearson correlation	.723**	.655**	1	.804**
	Sig (2-tailed)	.000	.000		.000
	N	142	142	142	142
TSG post	Pearson correlation	.649**	.751**	.804**	1
	Sig (2-tailed)	.000	.000	.000	
	N	142	142	142	142

**Correlation is significant at the 0.01 level (2-tailed).

Assumption 7: There should be a linear relationship between the dependent variables for each group of the independent variables. Assumption 7 was met because there was a more linear relationship between the PALS and TSG pretest and posttest for lead teachers' years of experience, assistant teachers' levels of education, and assistant teachers' years of experience than for lead teachers' level of education, as assessed by the scatterplot in Figure 1.

Figure 1. *Scatterplot Matrix for the Independent and Dependent Variables*



Assumption 8: There must be an adequate sample size. Assumption 8 was met because there was an adequate number (*N*) in each case group. Assumption 9: There should be homogeneity of variance-covariance matrices. Assumption 9 was not met because the test was statistically significant at (p = .000). The assessment was conducted using a Box's test of equality of covariance matrices, and a test was considered significant at p < .001. Assumption 10: There should be homogeneity of variance. Assumption 10 was met as assessed by Levene's Test of Homogeneity of Variance (p > .05)

Results

Descriptive Statistics

The descriptive analysis of the scores of at-risk children's results in the PALS pretest and posttest and the TSG pretest and posttest in relation to the independent variables, lead and assistant teachers' levels of education, and teachers' years of experience are presented in Appendix A. The PALS posttest indicated that assistant teachers with an associate degree in ECE and with 5 to 10 years of experience had the highest mean of 65.4 within other independent variables. The TSG posttest showed that assistant teachers with an associate degree in ECE and overs 10 years experience had the highest mean of 55.5 within the independent variables.

One-Way MANOVA

Pillai's trace is highly recommended when some assumptions of MANOVA are not met because it offers the most powerful and robust statistics, especially if the homogeneity of variance-covariance does not meet the assumption and/or when the test is statistically significant at p < .001. It is also recommended when there are uneven cell sizes or a small sample size (Finch, 2020). Because this quantitative study did not meet Assumption 9, the homogeneity of variance-covariance, Pillai's trace was considered over other options that could be used to report a one-way MANOVA. Pillai's trace showed no value in the output of other groups of Independent Variable 1 except the assistant teachers' level of education, which was statistically significant on the combined dependent variables, F (8,264) = 2.511, p = .012; Pillai's trace ʌt = .141; partial ɲ2 = .071, as presented in Appendix B.

Univariate One-Way ANOVA

With an indication of a statistical significance of the assistant teachers' level of education among the groups of Independent Variable 1 (p = .012) indicating that p < .05, we ran a univariate one-way ANOVA to determine which of the dependent variables was contributing to the statistical significance of the one-way MANOVA report. The test of between-subject effect indicated that there was no statistically significant difference in the PALS pretest between at-risk children taught by assistant teachers based on levels of education. There was also no statistically significant difference in the TSG and PALS posttest, as presented in Appendix C.

We tested the research question using the result of the multivariate test and one-way univariate ANOVA. The multivariate result of Pillai's trace for assistant teachers' level of education indicated a statistical difference at p = .012. The research question was tested further to determine which of the dependent variables contributed to the statistically significant difference showed by assistant teachers' level of education by using a univariate one-way ANOVA. The test of between-subject results of the univariate one-way ANOVA indicated that no significant difference was found among the groups of dependent variables in relation to assistant teachers' levels of education. Lack of statistically significant difference does not require further post hoc tests to be conducted. Based on these findings, the null hypothesis for the research question that states there are no statistical differences in assessment scores of at-risk children when taught by teachers of different levels of education and years of experience was supported. The results of the one-way ANOVA are presented in Appendix C.

Discussion

The purpose of this quantitative study was to determine whether differences existed among lead and assistant teachers' levels of education and years of experience with regard to at-risk Pre-K 4 children's scores on standardized readiness assessments, specifically TSG (n.d.) and PALS (Invernizzi et al., 2004). This study was built on previous research by examining teachers' levels of education and years of experience that affect at-risk Pre-K 4 children's scores. Researchers have focused on examining the type of teachers' qualifications, specializations, certifications, and years of experiences that have promoted positive outcomes among infants, toddlers, and especially preschoolers, but they have not specifically considered lead and assistant teachers of at-risk children (Claire-Son et al., 2013; Falenchuk et al., 2017; Landry et al., 2017; Lin & Magnuson, 2018; Manning et al., 2017). Using the scores of two different standardized assessments relevant to at-risk Pre-K 4 children is a crucial contribution to the body of knowledge. Both standardized assessments, the TSG (n.d.) and PAL Pre K (Invernizzi et al., 2004), are formal assessments or screening tools measuring all domains of all categories of children's ability irrespective of their socioeconomic factors.

Based on the multivariate test used to test the statistical significance of the independent variable to the dependent variable, our findings indicated that assistant teachers' levels of education were related to significant differences in at-risk Pre-K 4 children's assessment scores, while lead teachers who had higher degrees and a state license showed no significant difference. This is consistent with research that used classroom assessment scoring system (CLASS) observations to examine the role of teacher–child interaction in children's outcomes and found that teacher-child interaction contributed more significantly to children's experience and preparation for school readiness than teachers' degrees (Pianta et al., 2008). Researchers have shown that irrespective of teachers' levels of education or experience, teacher–child interaction seems to contribute positively to children's learning and development (Early et al., 2017; Nasiopoulou et al., 2017). Similarly, other researchers have found that effective teaching and subsequent learning outcomes have resulted from teacher–child sensitive interaction to promote language and literacy outcomes rather than teachers' levels of education, materials, or activities (Hatfield et al., 2016; Nasiopoulou et al., 2017). Essentially, high-quality child outcomes and performance evolve from qualitative teacher–child interaction. Findings on teacher education have focused mainly on lead teachers, with less emphasis on assistant teachers, and little literature exists concerning the relevance of assistant teachers in children's learning (Curby et al., 2012). Interactions of the two categories of teachers may differ based on expected responsibilities and possible support from the assistant teacher.

The significant difference indicated by the assistant teachers of at-risk Pre-K 4 in this study may have occurred in the process of teacher–child interaction, as suggested by previous research (see Early et al., 2017; Hatfield et al., 2016; Pianta et al., 2008; Nasiopoulou, 2017). Our findings suggest that irrespective of teachers' levels of education, the role of assistant teachers should not be underestimated in at-risk children's learning process. Researchers have indicated that professional development is imperative to promote higher standards and hone the skills of teachers with minimal levels of education (Bleach, 2014; Lino, 2014).

It may be worthwhile for childcare centers such as Head Start agencies serving at-risk children to explore different forms of professional development, which may play a significant role in enhancing and honing the skills of teachers rather than relying on teachers' levels of education and years of experience. Rather than focusing entirely on teachers' levels of education and years of experience, the hiring process and interviews should address prospective candidates' actual demonstration of practice in the class before a selection is made. Teachers may perform excellently during oral interviews, but their ability to put knowledge into practice should be considered. The findings from this study suggest that teacher certification has no causal effect and is congruent with Claire-Son et al.'s (2013) study as licensed teachers had no significant effect on at-risk children's scores. Researchers have shown that children's learning occurs where there are positive interactions (Early et al., 2017; Nasiopoulou et al., 2017; Pianta et al., 2008), and lack of interaction of a certified lead teacher may hinder children's learning or developmental trajectories. Other possible options for the findings in this study may relate to how assistant teachers were trained (Buettner et al., 2016). Buettner et al. (2016) found that 4-year college curricula in the United States are focused on knowledge and theoretical aspects of CD, while the 2-year college curriculum is geared toward classroom practice and management. Considering the settings of preschool classrooms with more emphasis on practice and management, this may be why assistant teachers' levels of education were significantly different in the multivariate test result of at-risk children's scores in comparison with lead teachers with higher levels of education in this study. It is critical that at-risk children have committed teachers and assistant teachers who have a better understanding of the art of teaching and practice, which is essential to unlocking children's potential.

We did not find that teachers' higher levels of education, licensure, and years of experience affected at-risk children's assessment scores drastically when compared to assistant teachers with lower levels of education, such as associate degrees, as reported by some studies (see Barnett et al., 2011; Lin & Magnuson, 2018; Manning et al., 2017). It should also be noted that literature reviews have typically focused on teachers without distinguishing the type of teacher. Multiple researchers have argued that irrespective of the levels of education, exposure to professional development, training, coaching, and mentoring can change the pedagogy of teachers (Gomez et al., 2015; Piasta et al., 2015; Scarinci et al., 2015; Totenhagen et al., 2016). There were null associations between teachers of advanced degrees and at-risk children's assessment scores. To enhance at-risk children's assessment scores, we propose that at-risk children's programs practice student-centered coaching, which would involve coaching teachers to interact and relate with children based on developmental goals and activities that are developmentally appropriate and that are practiced daily. Bronfenbrenner's (1979) theory of ecological systems supports our finding as it indicated that developing children are influenced by the type of interactions and relationships they have with various systems. The findings of this study indicated that assistant teachers' level of education was statistically significant over other higher levels of teachers' education. This statistical difference may have occurred in the process of interaction.

Limitations

The target population for this study was specific to a Midwestern state in the United States and to a local Head Start program that serves at-risk Pre-K children. The levels of education of teachers in different Head Starts vary according to geographical location, country, and agency policies; therefore, the generalizability of this study may be limited to populations and programs that are similar to those identified in this study. The analysis and results of this study were based on archival data and may not be generalized to other experimental or nonexperimental studies.

The minimal sample size of the variables in this study may limit the generalization of the results to a homogenous population similar to that studied. The results of this study were reported based on comparing differences in variables, and no cause and effect may be determined for these results.

We recommend that future studies focus on the role of assistant teachers in the classroom to ascertain whether teacher-child interaction was the factor responsible for the findings in this study. Future research might include a pre- and post-CLASS assessment to find a possible correlation between teachers' CLASS scores and children's performance, as suggested by Early et al. (2017). The significance of assistant teachers' levels of education in at-risk and non-at-risk settings for Pre-K 4 children should be studied. To determine how much influence teachers' education has on at-risk children's assessment scores, we suggest that licensed teachers with high levels of education in EC or CD in the district schools within the state be compared to teachers with the same levels of education in Head Start settings using the same instrument. Based on the findings of this study, researchers may want to focus on how the collegial system of ECE might identify and align the focus of training of 4-year colleges and 2-year colleges with the actual requirements and classroom practices. For both categories, there is a need to incorporate applicability of CD, the role of positive interaction, and how at-risk children may be taught to significantly enhance their learning.

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Appendix A: Descriptive Statistics of Teachers' Levels of Education, Experience on PALS/TSG

Levels of education	Years of experience	Test	*M*	*SD*
MS/MA/BS/BA in ECE or related field and licensed in ECE	5-10	PALS pretest	45.1	30.2
			48.7	35.9
CDA, college credits, and high school diploma	0-5	PALS pretest	30.4	17.7
			32.5	25.5
		PALS pretest	45.1	30.2
			48.7	35.9
			32.5	25.5
			30.44	25.5
		PALS posttest	65.4	26.3
			64.77	36.0
			63.6	32.0
AS in ECE	5-10	PALS posttest	65.4	26.3
MS/MA/BS/BA in ECE or related field and licensed in ECE	5-10	PALS posttest	64.77	36.0
MS/MA/BS/BA in ECE or related field and licensed in ECE	0-5	PALS posttest	63.59	32.0
CDA, college credits, and high school diploma	5-10	PALS posttest	48.9	29.5
CDA, college credits, and high school diploma	5-10	TSG pretest	37.5	12.2
AS in ECE	10 years+	TSG posttest	51.8	7.4
MS/MA/BS/BA in ECE or related field and licensed in ECE	0-5	TSG posttest	46.4	7.4
		TSG pretest	37.46	12.2
		TSG posttest	51.8	7.4
AS in ECE	10 years+	TSG posttest	55.5	8.5
			51.8	7.4
AS in ECE	5-10	TSG posttest	51.2	6.6
MS/MA/BS/BA in ECE or related field and licensed in ECE	0-5	TSG posttest	49.6	6.6

Note. MS = Master of Science; MA = Master of Arts; BS = Bachelor of Science; BA = Bachelor of Arts; ECE = early childhood education; CDA = child development associate; AS = associate degree.

Appendix B: One-Way MANOVA Multivariate Results for Teacher and Test Score

Effect		Value	*F*	Hypothesis *df*	Error *df*	Sig.	Partial eta squared
Intercept	Pillai's Trace	.985	2177.056[b]	4.000	131.000	.000	.985
	Wilks' Lambda	.015	2177.056[b]	4.000	131.000	.000	.985
	Hotelling's Trace	66.475	2177.056[b]	4.000	131.000	.000	.985
	Roy's Largest Root	66.475	2177.056[b]	4.000	131.000	.000	.985
Lead_Edu	Pillai's Trace	.000	.[b]	.000	.000	.	.
	Wilks' Lambda	1.000	.[b]	.000	132.500	.	.
	Hotelling's Trace	.000	.[b]	.000	2.000	.	.
	Roy's Largest Root	.000	.000[b]	4.000	130.000	1.000	.000
Lead_Exp	Pillai's Trace	.000	.[b]	.000	.000	.	.
	Wilks' Lambda	1.000	.[b]	.000	132.500	.	.
	Hotelling's Trace	.000	.[b]	.000	2.000	.	.
	Roy's Largest Root	.000	.000[b]	4.000	130.000	1.000	.000
Asst_Edu	Pillai's Trace	.141	2.511	8.000	264.000	.012	.071
	Wilks' Lambda	.862	2.526[b]	8.000	262.000	.012	.072
	Hotelling's Trace	.156	2.540	8.000	260.000	.011	.072
	Roy's Largest Root	.125	4.138[c]	4.000	132.000	.003	.111
Asst_Exp	Pillai's Trace	.000	.[b]	.000	.000	.	.
	Wilks' Lambda	1.000	.[b]	.000	132.500	.	.
	Hotelling's Trace	.000	.[b]	.000	2.000	.	.
	Roy's Largest Root	.000	.000[b]	4.000	130.000	1.000	.000
Lead_Edu * Lead_Exp	Pillai's Trace	.000	.[b]	.000	.000	.	.
	Wilks' Lambda	1.000	.[b]	.000	132.500	.	.
	Hotelling's Trace	.000	.[b]	.000	2.000	.	.
	Roy's Largest Root	.000	.000[b]	4.000	130.000	1.000	.000
Lead_Edu * Asst_Edu	Pillai's Trace	.000	.[b]	.000	.000	.	.
	Wilks' Lambda	1.000	.[b]	.000	132.500	.	.
	Hotelling's Trace	.000	.[b]	.000	2.000	.	.
	Roy's Largest Root	.000	.000[b]	4.000	130.000	1.000	.000
Lead_Edu * Asst_Exp	Pillai's Trace	.000	.[b]	.000	.000	.	.
	Wilks' Lambda	1.000	.[b]	.000	132.500	.	.
	Hotelling's Trace	.000	.[b]	.000	2.000	.	.
	Roy's Largest Root	.000	.000[b]	4.000	130.000	1.000	.000
Lead_Exp *	Pillai's Trace	.000	.[b]	.000	.000	.	.

Effect		Value	*F*	Hypothesis *df*	Error *df*	Sig.	Partial eta squared
Asst_Edu	Wilks' Lambda	1.000	.[b]	.000	132.500	.	.
	Hotelling's Trace	.000	.[b]	.000	2.000	.	.
	Roy's Largest Root	.000	.000[b]	4.000	130.000	1.000	.000
Lead_Exp * Asst_Exp	Pillai's Trace	.000	.[b]	.000	.000	.	.
	Wilks' Lambda	1.000	.[b]	.000	132.500	.	.
	Hotelling's Trace	.000	.[b]	.000	2.000	.	.
	Roy's Largest Root	.000	.000[b]	4.000	130.000	1.000	.000
Asst_Edu * Asst_Exp	Pillai's Trace	.000	.[b]	.000	.000	.	.
	Wilks' Lambda	1.000	.[b]	.000	132.500	.	.
	Hotelling's Trace	.000	.[b]	.000	2.000	.	.
	Roy's Largest Root	.000	.000[b]	4.000	130.000	1.000	.000
Lead_Edu * Lead_Exp * Asst_Edu	Pillai's Trace	.000	.[b]	.000	.000	.	.
	Wilks' Lambda	1.000	.[b]	.000	132.500	.	.
	Hotelling's Trace	.000	.[b]	.000	2.000	.	.
	Roy's Largest Root	.000	.000[b]	4.000	130.000	1.000	.000
Lead_Edu * Lead_Exp * Asst_Exp	Pillai's Trace	.000	.[b]	.000	.000	.	.
	Wilks' Lambda	1.000	.[b]	.000	132.500	.	.
	Hotelling's Trace	.000	.[b]	.000	2.000	.	.
	Roy's Largest Root	.000	.000[b]	4.000	130.000	1.000	.000
Lead_Edu * Asst_Edu * Asst_Exp	Pillai's Trace	.000	.[b]	.000	.000	.	.
	Wilks' Lambda	1.000	.[b]	.000	132.500	.	.
	Hotelling's Trace	.000	.[b]	.000	2.000	.	.
	Roy's Largest Root	.000	.000[b]	4.000	130.000	1.000	.000
Lead_Exp * Asst_Edu * Asst_Exp	Pillai's Trace	.000	.[b]	.000	.000	.	.
	Wilks' Lambda	1.000	.[b]	.000	132.500	.	.
	Hotelling's Trace	.000	.[b]	.000	2.000	.	.
	Roy's Largest Root	.000	.000[b]	4.000	130.000	1.000	.000
Lead_Edu * Lead_Exp * Asst_Edu * Asst_Exp	Pillai's Trace	.000	.[b]	.000	.000	.	.
	Wilks' Lambda	1.000	.[b]	.000	132.500	.	.
	Hotelling's Trace	.000	.[b]	.000	2.000	.	.
	Roy's Largest Root	.000	.000[b]	4.000	130.000	1.000	.000

[a]Design: Intercept + Lead_Edu + Lead_Exp + Asst_Edu + Asst_Exp + Lead_Edu * Lead_Exp + Lead_Edu * Asst_Edu + Lead_Edu * Asst_Exp + Lead_Exp * Asst_Edu + Lead_Exp * Asst_Exp + Asst_Edu * Asst_Exp + Lead_Edu * Lead_Exp * Asst_Edu + Lead_Edu * Lead_Exp * Asst_Exp + Lead_Edu * Asst_Edu * Asst_Exp + Lead_Exp * Asst_Edu * Asst_Exp + Lead_Edu * Lead_Exp * Asst_Edu * Asst_Exp. [b]Exact statistic. [c]The statistic is an upper bound on *F* that yields a lower bound on the significance level.

Appendix C: Test of Between-Subject Results From Univariate One-Way ANOVA

Source	Dependent variable	Type III sum of squares	*df*	Mean squares	*F*	Sig	Partial eta squared
Correlated model	PALS Pre	5733.653[a]	7	819.093	.982	.447	.049
	PALS Post	5211.596[b]	7	744.514	.724	.652	.036
	TSG Pre	2229.194[c]	7	318.456	4.237	.000	.181
	TSG Post	1478.844[d]	7	211.263	3.414	.002	.151
Intercept	PALS Pre	183683.824	1	183683.824	220.159	.000	.622
	PALS Post	411505.814	1	411505.814	399.958	.000	.749
	TSG Pre	227297.150	1	227297.150	3024.052	.000	.958
	TSG Post	289028.105	1	289028.105	4671.226	.000	.972
Asst. Edu	PALS Pre	793.431	2	396.716	.475	.623	.007
	PALS Post	1315.986	2	657.993	.640	.529	.009
	TSG Pre	187.075	2	93.537	1.244	.291	.018
	TSG Post	158.452	2	79.226	1.280	.281	.019
Error	PALS Pre	111799.425	134				
	PALS Post	137869.052	134				
	TSG Pre	10071.855	134				
	TSG Post	8291.135	134				
Total	PALS Pre	347059.000	142				
	PALS Post	627754.000	142				
	TSG Pre	281697.000	142				
	TSG Post	346511.000	142				
Correlated total	PALS Pre	117533.078	141				
	PALS Post	143080.648	141				
	TSG Pre	12301.049	141				
	TSG Post	9769.979	141				

[a] R Squared = .049 (Adjusted R Squared = -.001). [b] R Squared = .036 (Adjusted R Squared = -.014). [c] R Squared = .181 (Adjusted R Squared = .138). [d] R Squared = .151 (Adjusted R Squared = .107).

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