

Teacher Effects on Reading Comprehension

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Project Adviser: Dr. Stephen A. Petrill, Professor
Department of Human Development and Family Science

Abstract

Background: Reading comprehension has a critical connection to effective reading and thus is of importance to learning outcomes. Studies have indicated that aspects of the teacher and classroom environment have a significant impact on learning, especially in regard to reading comprehension. **Objective:** The purpose of this study was to examine the effects of teachers and their attitudes on school environment on children's reading comprehension. **Methods:** The study was based on a sample of 200 pairs of monozygotic, (MZ; N = 83), and same-sex dizygotic, (DZ; N = 117), twins taking part in the Western Reserve Reading Project. Twins were assessed via annual home visits during early elementary school. Assessments included subtests of the Woodcock Reading Mastery Test (WJ Passage Comprehension and WJ Word ID) and the Peabody Individual Achievement Test (PIAT Reading Comprehension). Measures were examined using correlation between aspects of the teacher regarding opinions on school environment and reading comprehension scores between twins located in same versus different classrooms. **Results:** Although teacher attitudes did affect test performance, twin correlations were significant even when twins were located in different classrooms. It is essential to note that these relationships were also tempered by familial relationships that extend beyond the classroom. **Conclusions:** The results suggested that teacher-rated aspects of the classroom and larger school environment had an impact on twins' reading scores. This research not only aids in expanding the understanding of teacher effects on reading comprehension, but it also highlights the significance of improving instructional approaches that will increase reading ability and help decrease the onset of early reading problems.

Keywords: Reading, Twin, Teacher, Environment

Teacher Effects on Reading Comprehension

Learning to read is of monumental importance, representing one of the most significant events in any child's life. Reading is one of the principal means used for understanding and making sense of the world. With the ability to understand a written passage, reading comprehension symbolizes the shift from *learning to read* to *reading to learn*. It is what enables readers to interrelate with the text in a meaningful way. Thus, reading comprehension is the critical connection to effective reading, and therefore of major importance in every child's ability to obtain an education. The purpose of this study is to examine the effect teachers have on children's reading comprehension to improve instructional approaches that will increase reading ability and help decrease the onset of early reading problems.

Overview of the Development of Reading Comprehension

It is important to consider some of the ways individuals read words. For example, words can be read through analogy, noting similarities to familiar words (Jenkins & O'Connor, 2002). For children learning to read, this is a key technique used to discover new words. As children gain the knowledge of spelling-sound relations, (i.e., graphophonemic knowledge), and phonemic awareness, they learn to decode words, which involves mapping out phonemes onto appropriate letters and letter combinations. Through practice, children become skilled readers and can read words by analogy and decoding. However, many words are read by sight, (such as with high frequency words like *is* and *the*), where automatic word reading requires having words readily available in memory. Reading words by sight is occasionally referred to as orthographic reading, in contrast to alphabetic or phonological reading where words are read through decoding (Jenkins & O'Connor, 2002). Notably, repetition and decoding skills are needed to establish

sight words, and individuals must read extensively to encounter enough words in text that allow reading by sight.

Becoming a skilled reader involves development from many aspects. First, children need to understand that spoken words are made of smaller elements of speech, so that they have the phonological awareness to recognize printed words (McCardle, Scarborough, & Catts, 2001). Second, in order to attain strong reading comprehension skills, children must expand their overall knowledge and understanding that they will need when encountering messages conveyed by text. This incorporates having general background knowledge of concepts, an extensive vocabulary, fluency with syntactic and semantic sentence structures, and verbal reasoning abilities (McCardle et al., 2001). Importantly, all of these abilities must develop interactively and not in isolation. For example, decoding relies on using the alphabetic principle, which simultaneously relies on phonological awareness. Hence, not having strong reading comprehension ability can be a consequence of poor comprehension abilities, slow or incorrect word recognition skills, or both (McCardle et al., 2001).

Reading comprehension is a complex cognitive process that cannot be understood without a clear awareness of the role and meaning of the vocabulary in a passage of text. Reading, language skills, knowledge, and word reading ability are all mutually dependent and equally interconnected with each other in the development of reading comprehension (Jenkins & O'Connor, 2002). In regards to word reading, accuracy and speed are two significant aspects for comprehension. Accuracy is vital to acquiring the meanings through the words from text, and speed is significant, since students skilled in reading comprehension can read single words faster than students with poor reading comprehension (Jenkins & O'Connor, 2002). Due to the complexities of learning to read and acquiring a skilled level of reading comprehension, it is

rightful to be concerned about early identification of children at risk for reading difficulties so that their reading problems do not progressively exacerbate.

Importance of Detecting Reading Difficulties Early

For some children, reading comes effortlessly; however, for others it can be a struggle. In McCardle, Scarborough, and Catts's study on preventing children's reading difficulties, they describe three considerations relative to predicting and explaining reading problems. First, studies have shown that differences among children in their reading abilities and disabilities are fairly stable over time (McCardle et al., 2001). Second, once students reach about seventh grade, progress generally slows considerably, where the skill level a child has in early adolescence is not far from the following achievement on which that child will depend on for the rest of his or her life (McCardle et al., 2001). Third, among children who have difficulty learning to read, the greatest challenge to early success is usually in mastering word-recognition skills, especially decoding (McCardle et al., 2001).

Thus, it is critical to detect reading difficulties and disabilities early in a child's development of reading skills. As McCardle, Scarborough, and Catts stress, if students can be reliably identified as having reading difficulties, "then appropriate intervention can be provided before a small problem becomes a larger and more intractable one" (2001, p. 231). If this occurs, the overall reading achievement of school children will steadily rise. Since fewer children will then require special educational instruction, those children who still do can receive the support they truly need and deserve (McCardle et al., 2001). Significantly, all teachers must be comprehensively trained in reading and reading instruction, and there must be reading instructional programs that sustain in all the complex school environments.

Classroom Environment Effects

In addition to teacher effects, there is significant indication of overall classroom effects impacting learning outcomes, especially in regards to reading. For instance, children who are located in different classrooms are more likely to have different social networks than those of children located in the same classroom. Student perceptions of classroom environment in regards to perceptions of the class's attitudes towards learning, affect the motivation of individual students, independent of particular teachers (Marsh, Martin, & Cheng, 2008). In fact, research indicates that peers within the same classroom might play a role in psychological and educational well-being, in which qualities of schools have a significant impact on academic progress (Rutter & Maughan, 2002).

It has been suggested that overall classroom effects have an impact on learning outcomes. For instance, the Twins Early Developmental Study in the United Kingdom distinguished higher shared environment effects in same- versus different- class twins assessed not only in reading, but also in mathematics, science, and other aspects of English (Kovas, Haworth, Dale, & Plomin, 2007). This study used teacher ratings of overall school performance, representing not only classroom effects but also school effects, expressing the results in terms of changes in shared environment.

A (2009) study examined the impact of classroom effects on reading development and literacy (Byrne, Coventry, Olson, Wadsworth, Samuelsson, & Petrill, 2009). The data for this study came from an ongoing longitudinal study of young twins, the International Longitudinal Twin Study, in which the maximum sample comprised 711 twin pairs. There were 355 MZ pairs and 356 same-sex DZ pairs (Byrne et al., 2009). By using objective testing and calculating the correlations between pairs of twin children who either shared or did not share a teacher in

kindergarten, Grade 1, and Grade 2, this study was able to examine the significance of classroom effects. For both MZ and DZ twins, twin pairs located in the same classroom were more highly correlated than pairs located in different classrooms for most measures at each grade level. Thus, the results indicated that the general trend was higher correlations among same-class pairs, indicating a classroom effect on reading outcomes (Byrne et al., 2009).

It is important to note that these data did not provide much support for a change in classroom effect overtime. The higher MZ correlations compared with DZ correlations demonstrated that MZ twins stayed more in accordance with each other through time than did DZ twins, congruous with other evidence that stability in literacy growth is to an extent due to genetics. (Byrne et al., 2009). Nevertheless, it is evident that classroom effects on reading performance have been identified. In fact, most related research deals with *classroom effects*, for the idea that differences in reading and overall classroom performance are due to the teacher is mostly an assumption (Byrne et al., 2009). As discussed in the following sections, differences in particular teacher characteristics may represent a root of variability in reading and overall educational outcomes.

Reading Comprehension Instruction

The training and preparation of teachers to educate students on developing and expanding reading comprehension strategies to enhance understanding is closely connected to students' achievement in this matter. Regarding the development of reading comprehension, it is important for teachers to start children's reading instruction early with all the crucial aspects of reading and reading comprehension simultaneously. A 2009 study, researched by Block, Parris, Whiteley, and Cleveland, was designed to test which instructional approaches hold the greatest potential to increasing reading comprehension by examining the effects of six common

theoretically grounded instructional environments on student's comprehension abilities; "the study was a quantified experimental versus controlled group comparison" (p. 262).

Several major findings resulted from the preceding study. The instructional approaches that were examined, (that are used most in U.S. elementary and secondary schools), included "(a) workbook practice, (b) individualized schema-based learning, (c) situated practice, (d) conceptual learning, (e) transactional learning, and (f) traditional, basal instruction" (Block et al., 2009, p. 263). Data indicated that in and of itself, more time in basal approaches is not a strong enough instructional environment for all students in grades two through six to increase overall reading abilities (Block et al., 2009). This learning environment, consisting of teacher-led group activities and meetings, in addition to workbook and situational practice, resulted in the lowest levels of achievement growth on every measure. Interestingly, student choice is not a component of the previous approach, resulting in less student motivation to read and therefore less advancement on improving comprehension ability.

The findings of the previous study demonstrated that below-grade-level readers perform considerably better or as well as more able peers when they are able to read from class books for fifteen to twenty minutes supplementary to seventy minutes of basal instruction daily and are guided by their teachers in one of three ways (Block et al., 2009). In the study, the three most effective instructional methods used by teachers include (1) individualized-schema-based learning, which enables students to experience voluntary reading of class books of interest depending on personalized scaffolds as they are read; (2) conceptual learning, where two expository books on the same topic are read consecutively before students progress to read about a different expository topic; (3) transactional learning, in which books that are read relating to a

thematic topic are followed by an open-ended, student-dominated, teacher-led, whole-class discussion (Block et al., 2009).

Hence, individualized-schema-based learning, conceptual learning, and transactional learning prove to be the most effective for students, and thus should be used more widely in schools. Though all six instructional approaches require approximately the same amount of time from the teacher, the specific actions that the teachers take, (with the preceding three approaches), optimally support students during silent reading periods, generating significant growth in students' comprehension level (Block et al., 2009). Additionally, it is important to note that the study found increasing evidence that the classroom environment, in regards to the abundance of book choice, is a vital component of student motivation and therefore of students' prospects of improving their reading skills (Block et al., 2009). More research is needed to determine the best way to train teachers to implement different instructional approaches and identify which students need which approaches.

The Significance of Teacher Practices through Parenting Style

During the 1960s and early 1970s, Baumrind observed critical social and cognitive differences in preschoolers, finding a correlation between competent and highly socialized children with parents who made developmentally appropriate demands and controlled child behavior as needed, yet were responsive, affectionate, and effective communicators (Walker, 2008). Baumrind used two dimensions for the structure of classifying parenting styles, where "one dimension, *demandingness*, entails firm behavioral control, autonomy support, and expectations. The other dimension, *responsiveness*, involves warmth and care, provision of resources, and adaptation to individual needs" (Walker, 2008, p. 219).

Importantly, variations among these two dimensions yield different parenting styles, which hold consequences for children's social and intellectual development. The authoritative style, which is high on both dimensions, the authoritarian style, which is high in demandingness and low in responsiveness, and the permissive style, which is low in demandingness and low in responsiveness, represent the three major parenting styles characterized by Baumrind. Generally, the authoritative parenting style is regarded as the most successful due to its balance of *demandingness* and *responsiveness*, appreciating children's needs for autonomy and their ability to conform to expectations. Thus, Baumrind found that children with authoritative parents had the most success in all areas, whereas children with authoritarian and permissive parents tended to have less favorable social and academic outcomes (Walker, 2008).

Like parents, teachers create optimal environments for the development of student social and academic competence when their practices reflect an authoritative approach. Consistent with research in parenting, Joan Walker performed a research study examining teacher practices through the aspect of parenting style, which illuminated that students with higher levels of competence and achievement have teachers who use firm control, such as using punishment and rewards consistently and giving clear directions, and are responsive to children's needs, such as by providing rationale and explanation for tasks (Walker, 2008). The results of this study present increasing support for the value of looking at classrooms through the aspect of parenting style. Walker used discourse analysis to assess teacher style, (i.e. the balance of *demandingness* and *responsiveness*), across classrooms, as well as assessing teacher style, student engagement, and self-efficacy beliefs through student surveys (Walker, 2008).

In addition, Walker gathered information about teacher style and use of *mastery-* and *performance-focused* practices through interviews, where *mastery-focused practices* involve

emphasis on problem-solving skills and *performance-focused practices* entail the importance of meeting external expectations. Walker conveyed that “although all teachers used similar mastery- and performance-focused demands, students in the authoritarian context reported relatively lower academic self-efficacy” (Walker, 2008, p. 236). This discovery most likely stems from the limited support for student autonomy given from the teacher, explaining the results that students of the authoritarian teacher demonstrated more self-handicapping behaviors and lower social self-efficacy when relating to the teacher (Walker, 2008). Importantly, students with permissive teachers made lower academic gains, and the results displayed that authoritative teaching provides the most advantageous context for student engagement and learning.

Behavioral Genetics of Reading

For many years, research has revealed that reading problems are family-related, where approximately 25% to 50% of children with reading disabilities have a family member with a reading disability (Pennington & Smith, 1983). Thus, behavioral genetics research has demonstrated that genetics are of immense importance to family similarity in reading ability and disability. Though the shared family environment is significant, it is imperative to consider the impact of genetics, especially in regards to reading. The research of Bartels, Rietveld, Van Baal, and Boomsma has indicated that “continuity in cognitive abilities is mainly due to additive genetic factors” (Bartels et al., 2002, p. 246). Their longitudinal twin study researched the influences of genes and the environment on cognitive development. Notably, results indicated an increase of genetic influences on cognitive functioning throughout development in the twins, providing consensus among related data (Bartels et al., 2002).

Hence, the unique environment that an individual experiences contributes to change rather than stability in cognitive performance. As Dr. Petrill states in his special issue on

“Genes, Environment, and the Development of Reading Skills,” the environment can be divided into two types: the *shared environment* and the *nonshared environment* (in press). The *shared environment* represents anything that makes family members similar that is not explained by genetic differences. For instance, two siblings that share the same home, have the same socioeconomic status, and attend the same school would reflect a shared environment. With twin studies, shared environment is typically suggested when identical twins and fraternal twins are uniformly alike (Petrill, in press).

The *nonshared environment*, on the contrary, represents anything that makes family members different. For example, even though siblings may share the same home and school environment, they may have different friends, teachers, and educational experiences. As Dr. Petrill emphasizes, the nonshared environment is best measured when observing identical, or monozygotic, twins living together (in press). Thus, any differences between identical twins living together, since they share 100% of the same genes, must be due to nonshared environment and random influences, to include error (Petrill, in press). This method of using twin studies demonstrates how genetically sensitive designs can be systematically used to examine reading development in addition to illuminating why such studies are essential to concepts of reading.

Through examining family members who differ in their degree of genetic relatedness, quantitative twin, sibling, and adoptee studies have the potential to measure behavior, such as reading, through dissecting the differing genetic and environmental components. For example, fraternal twins share 50% of the same genes, on average, compared to identical twins who share 100% of the same genes. Biological siblings share 50% of the same genes, on average, while adoptive siblings do not share any genes (Petrill, in press). Thus, if identical twins are more similar than fraternal twins, or biologically related siblings are more similar than adoptive

siblings, then it is understood that genes have an influence on the relationship between similarities. With similar logic, if identical twins or biological siblings are no more similar than fraternal twins or adoptive siblings, respectively, then shared environment is understood to have an influence on the relationship (Petrill, in press).

Quantitative genetic methods may be used to examine the complex relationships among reading and related cognitive and socioemotional outcomes. This method allows researchers to ask meaningful questions about how a set of variables relates to one another, which can then be “assessed concurrently to examine the relationship among variables at a given age, or they may be assessed longitudinally to study genetic and environmental effects on development (Petrill, in press, p. 191). Researchers would not be able to use molecular genetics as comprehensively without the recent and ongoing findings of DNA. Many researchers look at genes through a *deterministic* manner, where the gene is observed as both necessary and sufficient to cause a disease. This “one gene, one disorder” approach is highly significant, but not useful to the understanding of how genetics affect reading (Plomin, 2001). Alternatively, the *quantitative trait locus*, (QTLs), approach is used in measuring reading, since it views multifaceted traits as being influenced by a number of complex genes of relatively small size (Plomin, 2001). Since reading is influenced by a number of genes, this approach maintains to be successful, for it recognizes the specific genes that relate to some small part of the entire genetic variance (Petrill, in press). Concisely, genetics, in addition to environment, are extensively significant to all aspects of reading.

The Western Reserve Reading Project

The Western Reserve Reading Project is headed by Dr. Stephen Petrill, Professor of Human Development and Family Science at the Ohio State University. Dr. Petrill has been

using twin designs and association designs to look at how genes influence the development of reading in children. Thus far, the results of Dr. Petrill's work suggest that genes are significant, even in early reading, where genes tend to signify similarity in reading over time and the equally important environment ultimately tends to create differences in reading. In addition, it is significant to note that his studies have indicated that genes related to reading may influence the environment that children are exposed to, and they are also related to and can help explain reading problems.

Hence, the data for this proposed study originates from the Western Reserve Reading Project, which centers on evaluating the involvement of genetic and environmental factors that affect the development of early reading skills that therefore influence subsequent reading skills, to include reading comprehension. The project is an ongoing longitudinal study involving identical and same-sex fraternal twins assessed across five home visits that is federally funded by the National Institutes of Health. Over the past five years, around 350 pairs of twins have participated in data collection sessions annually. Recruiting for the study was controlled through school nominations, Ohio State Birth Records, and media advertisements. The project secured cooperation from 273 schools throughout the state of Ohio, and schools aided in recruitment by sending an information packet to parents with twins in their school systems.

The Western Reserve Reading Project addresses four study aims. The first is to assess the univariate genetic and environmental influences on reading comprehension and interrelated skills from middle childhood to early adolescence. The second involves examining both the genetic and environmental influences on the covariance between language skills, decoding skills, and reading comprehension skills. The third entails observing the relationship between proximal and distal measures of the home and school environments that are associated with reading

comprehension and related skills. Lastly, the fourth aim is to explore how the genetic and environmental influences related to reading comprehension in early adolescence are longitudinally associated with reading skills in early and middle childhood. Thus, the new data collected as part of the project will be used concurrently and analytically with the project's previously collected data.

The initial proposed goal of the project was to explore and analyze the environmental influences on early reading in the context of a genetically sensitive design. Each of the 350 pairs of identical and same-sex fraternal twins have been assessed annually through an extensive succession of cognitive, reading-related, and environmental measures, in which all the recruited twins in the first visit, or wave, were between being enrolled in kindergarten but not having finished first grade. This ensured that the relationship between age versus months of formal education could be assessed. The second and third waves were performed within one month of the one-year mark of the previous home visit (Petrill, 2007). Hence, kindergartners and first graders made up the first wave, who then matured into first and second grade in the second wave, who then entered grades two and three in the third wave. For each of the home visits, parent and teacher reports are collected to assess relevant aspects of reading of the home and school environment and each child's behavior.

Depending on the age of the child, a math home visit was conducted, (the fourth wave), for the first time when the children were eight years of age and was planned at the six-month interval between the second and third visits or six months after the third visit. The project recently received additional funding to perform more math visits. It is important to note that the Western Reserve Reading Project is the first study to systematically examine the genetic and environmental independence between early reading and math skills. The goal of the project's

second continuing period that is ongoing is to conduct a methodical genetic examination of the development of reading comprehension in the context of concurrent and previous oral language skills, decoding skills, behavioral skills, and the home and school literacy environment. Through three additional home visits spanning middle childhood to early adolescence, data will be collected regarding the behavior, education, and environment from the twins, their parents, and the twins' reading teachers.

Human Subjects Concerns and IRB Approval

The Western Reserve Reading Project is dependent upon cooperation of families and consistent access to children, since its goal is to examine the development of reading. Families are sent letters after being recruited into the project and then with updates, such as when recently introducing the new phase of the study. Families who responded were contacted by phone and given a brief description of the new study, its purpose, as well as an overview of data collection procedures. The Western Reserve Reading Project has been approved by the Institutional Review Board, given approval number 2006B0291. The project does everything possible to guarantee adequacy of protection against risks. All families that have been recruited into the project have given informed consent and have had all significant information of the project described to them in detail.

The interviewers that attend the home visits are trained extensively on the procedures and have significant experience with children in the objective age range. Additionally, the questionnaires and tasks involved in the study have all been repeatedly used with children with no noticeable reported risks beyond those connected to daily life. Research assistants are also trained expansively on the importance of confidentiality and on interacting professionally with participating families. Importantly, as part of the Western Reserve Reading Project, participants

are assigned unique identification numbers that are separated from the master list of family names and identification numbers. All DNA and lab notes are labeled with an exclusive DNA identification number that is stored separate from the more general identification numbers. Reducing potential risks to confidentiality, all data is reported as aggregates and never recognized by individual's names. As a whole, the benefits have been proven to far outweigh the risks in this research in regards to the families and the important knowledge to be gained.

Method

Participants

This study was based on a subsample of the ongoing fifth home visit, (which represents the first assessment in a new funding period where the goal is to intensively measure both reading and math performance). Twins were approximately ten years old during this wave, ($M = 9.85$ yrs, $SD = .88$ yrs, range = 8.42-12.25 yrs). Though data collection for this wave assessment is still continuing, currently there were 200 pairs of analyzable data of monozygotic, (MZ; $N = 83$), and same-sex dizygotic, (DZ; $N = 117$), twins with known zygosity. The twins' zygosity was verified through a cheek swab, using DNA analysis. However, for the cases where DNA analysis was not possible, ($N = 41$ families), zygosity was determined using a questionnaire given to parents on twins' physical similarities, (Goldsmith, 1991). Most families were two-parent households, (93%), and nearly all families were Caucasian, (91% of mothers, and 94% of fathers). Additionally, the education levels of parents varied widely, and were similar for mothers and fathers, (14% high school or less, 16% some college, 38% bachelor's degree, 24% some post-graduate education or degree, 4% not specified).

Procedures and Measures

The quantitative data used for this research examined the relationships among teachers' opinions on aspects of school environment and their effects on reading comprehension outcomes in pairs of twins. In regard to selecting twins in classrooms, this study followed a precise method. Every teacher involved in the data had a teacher identification number (TID), and this study classified twins in different classrooms if the twins had teachers with different TID's and in same classrooms if their data was associated with the same TID. Then, correlational measures between the teacher variables and twin testing variables were taken and analyzed.

With respect to analyzing reading comprehension ability of the twins, two independent measures were given to each twin at their annual home visit. The first test was the Woodcock Reading Mastery Test, which included the two subtests *Passage Comprehension* and *Word Identification* (WRMT; Woodcock, 1987). Consisting of a cloze procedure format, these tests measured reading comprehension and word decoding by having the child read a short passage to identify a missing key word that made sense in the context of that passage. The second test used as data for this study was the *Reading Comprehension* subtest of the Peabody Individual Achievement Test (PIAT; Markwardt, 1997). In this test, the participants had to read a sentence and then select the picture, from four choices, that best represented the meaning of the sentence.

Furthermore, the aspects of the teacher were examined to assess the teacher effects on reading outcomes. The scale used as data for the purpose of this study was the *School-Level Environment Questionnaire* (SLEQ). This instrument measured teachers' perceptions of eight psychosocial dimensions of the environment of primary or secondary schools, including Affiliation, Achievement Orientation, Centralization, Formalization, Innovativeness, Professional Interest, Resource Adequacy, and Student Supportiveness (Rentoul & Fraser, 1983).

Thus, SLEQ represented a teacher-specific measure in regards to school, for teacher's had to circle the correct statement that described how they felt with respect to school environmental aspects. There is indication of SLEQ's benefits in research into the effects of school-level environment on classroom-level environment and on teacher's attitudes on education and instruction (Rentoul & Fraser, 1983).

It is important to understand the descriptions of the scales in the SLEQ. For instance, *Affiliation* regards the idea that teachers can obtain advice and assistance by their colleagues, and a sample item includes "I feel that I could rely on my colleagues for assistance if I should need it." The scale *Achievement Orientation* involves the encouragement from teachers by expecting high student achievement and valuing competition, such as when answering the item "students at this school are seldom under pressure to excel at academic work." Also, *Centralization* encompasses decisions made within the school by an individual or small group, where a sample item is "teachers are frequently asked to participate in decisions concerning administrative policies and procedures." *Formalization* regards teachers being expected to comply with rules and procedures, such as with the item "I am often supervised to ensure that I follow directions correctly."

Additionally, the *Innovativeness* item relates to the school encouraging experimentation and individualization, asking a sample item such as "teachers are encouraged to be innovative in this school." *Professional Interest* involves teachers discussing professional matters and showing interest in their work, and a sample item includes "teachers frequently discuss teaching methods and strategies with each other." Also, the *Resource Adequacy* item revolves around the idea of suitable support personnel, facilities, finance, and resources available, such as with the item "the supply of equipment and resources is inadequate." Lastly, *Student Supportiveness*

regards having good rapport between teachers and students in which students behave responsibly, including the sample item “there are many disruptive, difficult students in the school” (Rentoul & Fraser, 1983). The items for these eight scales were scored by allocating the responses Strongly Agree, Agree, Not Sure, Disagree, and Strongly Disagree using a predetermined method to calculate scores. School environmental factors influence not only the classroom environment itself, but also teachers’ pedagogical attitudes.

Results

Descriptive Statistics

Table 1 presents means and standard deviations of the variables of PIAT Comprehension, Woodcock Johnson Passage Comprehension, Woodcock Johnson Word ID, SLEQ Affiliation, SLEQ Achievement Orientation, SLEQ Centralization, SLEQ Formalization, SLEQ Innovativeness, SLEQ Professional Interests, SLEQ Resource Adequacy, and SLEQ Student Supportiveness for all wave 5 pairs of twins, for twins located in the same classrooms, and for twins located in different classrooms. The norms in this table serve as a guide to the representativeness of the samples. These data suggest that the means and standard deviations of the variables were approximately the same as the population means and standard deviations. Generally, the means and standard deviations of twins located in the same classroom and twins located in different classrooms are representative compared to the means and standard deviations of all twins.

First, we examined whether average levels of performance differed in twins that were placed in same versus different classrooms. Table 2 presents the t-test results for all of the output variables. The t values range from -1.36 to 2.77 with SLEQ Affiliation ($t=2.10$, $p=.04$) and SLEQ Professional Interests ($t=2.77$, $p=.01$) reaching statistical significance. Table 2

indicates if the means for twins being in the same classroom and in different classrooms differ from one another. Generally, there was no noteworthy difference between average levels of performance for twins that were placed in same versus different classrooms.

Next, we examined how teacher/classroom variables, (SLEQ), correlated to reading scores for all twins and twins that were placed in same versus different classrooms. Table 3 reports the correlations of teacher/classroom variables with twins' reading scores in all pairs of twins, in twins located in the same classroom, and twins located in different classrooms. The information in this table indicates if the variables of twins located in the same classroom and twins located in different classrooms have an impact on reading scores. Seven variables were significant. Across all reading measures for the variable SLEQ Achievement, the data were significant for all pairs of twins for PIAT Comprehension ($r = .23$), Woodcock Johnson Passage Comprehension ($r = .19$), and Woodcock Johnson Word ID ($r = .20$). For twins located in different classrooms, the PIAT reading comprehension measure for the same variable, SLEQ Achievement, reached statistical significance (PIAT Comprehension=.31).

Finally, we examined correlations for the twin testing variables to determine if the data indicated a classroom/teacher effect on reading scores. Table 4 reports the correlations for the testing variables as a function of same or different classroom assignment for pairs of twins. The information in this table specifies if classroom environment and aspects of the teacher have an impact on twin's reading scores. In regards to twins located in the same classroom, the data were not statistically significant. Importantly, all three testing variables correlated with one another for twins located in different classrooms reached statistical significance (PIAT Comprehension/Woodcock Johnson Comprehension=.62, PIAT Comprehension/Woodcock

Johnson Word ID=.54, Woodcock Johnson Comprehension/Woodcock Johnson Word ID=.67). Therefore, these data provide support for a classroom/teacher effect on twins' reading scores.

Discussion

These data suggest that classroom environment and aspects of the teacher have an impact on twin's reading scores. The data were statistically significant for variables for twins located in different classrooms, providing support for a classroom/teacher effect on twins' reading scores. It is important to note that these relationships were also tempered by familial relationships that extend beyond the classroom. The seven variables that reached statistical significance in regards to variables for twins located in separate classrooms versus different classrooms indicate that twins located in the same versus different classrooms have an impact on overall reading scores. The analyses indicate that the variable SLEQ Achievement Orientation was most significant, which involved a more teacher-specific scale regarding teachers valuing and encouraging student competition and achievement. Thus, the overall attitude towards students excelling in achievement appears to have an impact on reading comprehension outcomes.

It is important to note that the twins in this study were spread across two-hundred-and-seventy different schools; this combined with the fact that there was only a small sample size available of solely monozygotic twins located in separate classrooms illuminates limitations to this study. Since this study could not narrow the findings to only monozygotic twins located in nonshared environments, this limitation must be taken into consideration. If we have the available data, in the future it would be beneficial to include only monozygotic pairs of twins that are placed in separate classrooms. By focusing on monozygotic twins that share 100% of their segregating genes, (whereas dizygotic twins share 50% on average), it would be possible to correlate teacher effects with twins' reading comprehension abilities since the twins would be

located in separate classrooms, yet share the same home and school environment. Additionally, since aspects of the teacher were determined only through questionnaires, it is important to consider the limitation that the teachers were not directly assessed in the classroom.

Nevertheless, this paper is useful despite the limitations, for it examines the effects teachers and classroom environments have on children's reading comprehension. This research helps to answer the questions: What can teachers do to help promote positive outcomes with reading comprehension? Does classroom/school environment, regarding teacher opinions of the school, affect reading comprehension outcomes? This study has significant implications as it examines how teaching attitudes and instruction, and other aspects of the overall classroom environment affect reading comprehension ability.

Becoming a skilled reader involves development from many aspects. Reading comprehension instruction is a key factor that may significantly effect reading outcomes. More research is needed to determine how much teacher instruction influences reading outcomes to determine the best way to train teachers to implement different instructional approaches and identify which students need which approaches. Nevertheless, it is evident that improving instructional approaches could increase reading ability and help decrease the onset of early reading problems (2009, Block, Parris, Whiteley, and Cleveland). Though this study did not have enough data on teaching styles, it is important to note that this aspect of the teacher may also have a critical impact on reading outcomes. It would be beneficial to determine if different teaching styles correlate to different reading comprehension outcomes for twins.

Additionally, this study provides further evidence that the classroom environment as a whole has a significant role in reading outcomes for students. Thus, not only do factors of the teacher effect learning, but overall issues related to classroom environment, such as the ideas of

peer social networks and class attitudes towards learning, have an impact on motivation and academic progress (Marsh, Martin, & Cheng, 2008; Rutter & Maughan, 2002). In the Byrne et al. (2009) study, same-class correlations were generally higher than different-class correlations for twin pairs, indicating a classroom effect on reading outcomes (Byrne et al., 2009). Most importantly, school and classroom environmental factors not only directly influence children and their learning outcomes, but they also affect teachers' pedagogical attitudes, which appears to have a significant impact on reading outcomes, especially in regard to encouraging achievement (Rentoul & Fraser, 1983).

This research helps contribute to the existing knowledge in the comprehensive fields of teaching and learning, reading development, and genetic and environmental influences on reading, among many others. Moreover, it has the potential to build consensus among research findings concentrated on children's experiences in the two main developmental contexts of home and school, connecting with previous and current research related to teaching instruction in respect to the classroom environment. Significantly, this research not only aids in expanding the understanding of teacher effects on reading comprehension ability of students, but it also highlights the importance of improving instructional approaches that will increase reading ability and help decrease the onset of early reading problems.

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Table 1: *Means and Standard Deviations*

Variable	All	Same Class	Different Class
	M (SD)	M (SD)	M (SD)
PIAT Comp	106.02 (11.41)	106.33 (10.0)	102.08 (10.09)
WJ Passage Comp	103.49 (11.09)	103.76 (9.16)	101.04 (11.48)
WJ Word ID	106.87 (10.40)	108.04 (8.10)	103.98 (11.63)
SLEQ Affiliation	30.89 (3.36)	32.07 (2.88)	30.46 (3.46)
SLEQ Achievement	26.82 (3.73)	26.57 (3.28)	26.69 (4.28)
SLEQ Centralization	18.47 (4.15)	17.07 (4.18)	18.29 (3.62)
SLEQ Formalization	20.93 (4.04)	20.96 (3.77)	20.12 (3.71)
SLEQ Innovativeness	25.63 (3.95)	27.18 (3.19)	25.71 (3.35)
SLEQ Prof. Interest	28.57 (3.79)	30.0 (3.09)	27.90 (3.29)
SLEQ Resource Ad.	26.52 (4.44)	27.29 (4.29)	26.10 (4.58)
SLEQ Student Supp.	29.09 (3.75)	29.86 (3.53)	29.58 (3.10)

Table 2: *T values (t), Degrees of Freedom (df), and P-values (p)*

Variable	t	df	p
PIAT Comp	1.83	78	0.07
WJ Passage Comp	1.09	77	0.28
WJ Word ID	1.64	78	0.11
SLEQ Affiliation	2.10	78	.04*
SLEQ Achievement	-0.13	78	0.90
SLEQ Centralization	-1.36	78	0.18
SLEQ Formalization	0.97	78	0.33
SLEQ Innovativeness	1.90	78	0.06
SLEQ Prof. Interest	2.77	78	0.01*
SLEQ Resource Ad.	1.13	78	0.26
SLEQ Student Supp.	0.37	78	0.71

Note: * = $p < .05$

Table 3: *Correlations for SLEQ with Reading Scores*

Variable	PIAT Comp	WJ Passage Comp	WJ Word ID
All			
SLEQ Affiliation	-0.07	-0.09	0.01
SLEQ Achievement	0.23*	0.19*	0.20*
SLEQ Centralization	0.08	0.18*	0.16
SLEQ Formalization	0.06	0.15	0.19*
SLEQ Innovativeness	-0.01	-0.10	-0.01
SLEQ Prof. Interest	0.01	-0.01	0.08
SLEQ Resource Ad.	0.06	-0.02	-0.03
SLEQ Student Supp.	-0.07	0.04	-0.02
Same Class			
SLEQ Affiliation	-0.18	-0.37*	-0.27
SLEQ Achievement	0.28	0.19	0.33
SLEQ Centralization	-0.10	-0.27	-0.21
SLEQ Formalization	0.03	0.04	0.07
SLEQ Innovativeness	0.18	0.11	0.25
SLEQ Prof. Interest	0.08	0.03	0.20
SLEQ Resource Ad.	-0.21	-0.06	-0.22
SLEQ Student Supp.	-0.29	0.12	-0.21
Different Class			
SLEQ Affiliation	-0.18	-0.08	-0.03
SLEQ Achievement	0.31*	0.18	0.16
SLEQ Centralization	0.11	0.13	0.24
SLEQ Formalization	0.09	0.13	0.20

Variable	PIAT Comp	WJ Passage Comp	WJ Word ID
SLEQ Innovativeness	-0.20	-0.12	-0.01
SLEQ Prof. Interest	-0.09	-0.03	0.00
SLEQ Resource Ad.	0.13	-0.10	-0.08
SLEQ Student Supp.	-0.15	-0.03	-0.02

Note: * = $p < .05$

Table 4: *Correlations for testing variables in same versus different classrooms*

Variable	WJ Passage Comp	WJ Word ID
Same Class		
PIAT Comp	0.28	0.08
WJ Passage Comp		0.16
Different Class		
PIAT Comp	0.62*	0.54*
WJ Passage Comp		0.67*

Note: * = $p < .05$