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The Effect of Anxiety on the Measurement of Reading Fluency and Comprehension

Jeffrey A. Tysinger
Georgia Southern University

P. Dawn Tysinger
Georgia Southern University

Terry Diamanduros
Georgia Southern University, tdiamanduros@georgiasouthern.edu

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Abstract

The purpose of the current study was to examine the relationship between anxiety and performance on measures of reading fluency and reading comprehension in fourth, fifth, and sixth grade students. The study found that there is a significant negative correlation between social anxiety and reading comprehension but no significant correlation between social anxiety and reading fluency. These findings further demonstrate the distinction between the cognitive processes that underlie reading fluency and reading comprehension. The results also align with the tenets of Processing Efficiency Theory in that more complex tasks that significantly tax working memory (like reading comprehension) are more likely affected by anxiety than those tasks that do not rely as heavily on working memory (such as reading fluency).

THE EFFECT OF ANXIETY ON THE MEASUREMENT OF READING FLUENCY AND COMPREHENSION

Jeffrey A. Tysinger, P. Dawn Tysinger, and Terry Diamanduros
Georgia Southern University

April C. Earley
Gardner Edgerton Unified School District #231

Abstract: The purpose of the current study was to examine the relationship between anxiety and performance on measures of reading fluency and reading comprehension in fourth, fifth, and sixth grade students. The study found that there is a significant negative correlation between social anxiety and reading comprehension but no significant correlation between social anxiety and reading fluency. These findings further demonstrate the distinction between the cognitive processes that underlie reading fluency and reading comprehension. The results also align with the tenets of Processing Efficiency Theory in that more complex tasks that significantly tax working memory (like reading comprehension) are more likely affected by anxiety than those tasks that do not rely as heavily on working memory (such as reading fluency).

The Effect of Anxiety on the Measurement of Reading Fluency and Comprehension

With increased federal and state mandates for accountability, schools are increasing their efforts to insure quality instruction and positive student outcomes through frequent progress monitoring. Due to its impact on many academic areas, students' reading has received the most focus and attention in these efforts. As such, it is essential to insure that assessment for classroom monitoring and decision-making is maximally reliable, valid, and interpreted correctly.

In this regard, the current study investigated the effects of anxiety on the measurement of student reading fluency and comprehension. Based on the literature supporting Processing Efficiency Theory, the researchers hypothesized that students' assessed anxiety would have a greater influence on students' reading comprehension than their reading fluency.

Anxiety in Children

Anxiety is defined as "an abnormal and overwhelming sense of apprehension and fear often marked by physiological signs (such as sweating, tension, and increased pulse), by doubt concerning the reality and nature of the threat, and by self-doubt about one's capacity to cope with it" (Merriam-Webster's Medical Dictionary, 2002). Similarly, Bandura (1997) defined anxiety as "a state of anticipatory apprehension over possible deleterious happenings" (p. 137). Although many definitions of anxiety exist, the common elements of those definitions include *excessive worry* over real or perceived threats in the individual's environment. Both state and trait anxiety are believed to be components of the construct of anxiety. State anxiety is thought to be elicited by events in

the environment and is manifested as worry and nervousness specific to some immediate stressor. In comparison, trait anxiety is defined as a dimension of one's personality that includes a generalized predisposition to perceiving threats in all or most situations.

One type of anxiety common to childhood and adolescence is social anxiety and at its extreme social phobia. Social anxiety as defined in this study would be noted by distress over appearing incompetent or inadequate in performance situations and is relatively common in children and adolescents (Fisher, Masia-Warner, & Klein, 2004). This disorder is commonly manifested as a fear of being laughed at or ridiculed by peers or adults in situations where the child feels evaluated by others such as the academic and social context of school.

Anxiety and Academic Functioning

Children and adolescents spend many of their waking hours in school and commonly feel pressures of both academic and social evaluation in that environment. For many children the recognition of evaluation in school by peers and teachers leads to fear and worry associated with the aforementioned description of social anxiety. A growing body of literature highlights the detrimental effects of anxiety on school performance and achievement (Berg, 1992; Bonifacci, Candria, & Contento, 2008; Gumora & Arsenio, 2002; Kessler, Foster, Saunders, & Stang, 1995; Last & Strauss, 1990; Markham & Darke, 1991; Minnaert, 1999; Owayed El-Anzi, 2005; Sellers, 2000; Van Ameringen, Mancini, and Farvolden, 2003). Owayed El-Anzi (2005) reports negative correlations between measures of academic achievement and anxiety. Likewise, Gumora and Arsenio (2002) found that negative affect (like that of anxiety) had a detrimental effect on school performance even after controlling for cognitive variables (e.g., assessed intelligence). Finally, anxiety disorders have been linked with dropping out of school which has a variety of individual and social implications such as health problems, unemployment, criminal behavior and incarceration (Van Ameringen, et al, 2003). When the symptoms of social anxiety interfere with academic performance, the negative evaluation serves to confirm the negative self-perception about performance in evaluative situations (Fisher, Masia-Warner, & Klein, 2004).

Anxiety and Reading

Reading fluency is often defined as reading with appropriate rate, accuracy, and prosody (Fuchs, Fuchs, & Maxwell, 1988; Hudson, Pullen, Lane, & Torgesen, 2009; Shinn, Good, Knutson, Tilly, & Collins, 1992). A body of published research posits that there is a facilitative, reciprocal relationship between reading fluency and reading comprehension (Fuchs, Fuchs, Hosp, & Jenkins, 2001; Hudson, et al, 2009; Schwanenflugel, Meisinger, Wisenbaker, Kuhn, Strauss, & Morris, 2006). Schwanenflugel, et al, (2006) found support for a simple reading fluency model. The model purports that early readers must allocate significant cognitive resources to word recognition, thus limiting the resources available for reading comprehension. As word recognition improves, children become more automatic and fluent readers, and greater cognitive resources are available for improved reading comprehension. Although reading fluency may reach a level of automaticity, reading comprehension remains heavily

dependent on working memory capacity (Cain, Oakhill, & Bryant, 2004; Oakhill, Yuill, & Parkin, 1986; Seigneuric, Ehrlich, Oakhill, & Yuill, 2000). In fact, the process of reading comprehension in working memory was described by Daneman and Carpenter (1980, p. 450) as the following ". . .the reader must store pragmatic, semantic, and syntactic information from the preceding text and use it in disambiguating, parsing, and integrating the subsequent text."

Although reading fluency and reading comprehension are reciprocally related skills, there may be a differential effect of anxiety on each of the skills. In fact, research by Markham and Darke (1991) posits that anxiety interferes with verbal tasks (e.g., reading comprehension) that make heavy demands on working memory. Eysenck (1982) also reported that performance problems due to anxiety are most often associated with difficult cognitive tasks. In addition, Sellers (2000) found that participants who reported high levels of anxiety on self-report instruments recalled significantly less content on a foreign language reading comprehension evaluation than did participants experiencing lower levels of anxiety. In fact, the high-anxious participants also tended to experience more off-task, interfering thoughts that likely further disrupted the process of reading comprehension. Thus, many studies have identified the negative effect of anxiety on learning tasks, especially reading comprehension.

Reading fluency, at least among older students, is considered a more automatic process than reading comprehension, which requires repeated retrieval from long-term memory and continual processing in working memory. Because reading fluency operations do not require the same level of access to working memory as reading comprehension, there may be less effect on the performance of that skill. According to MacLeod and Donnellan (1993), automatic processes do not require the same level of access to working memory and are less affected by anxiety than processes with heavy reliance on working memory.

Processing Efficiency Theory

Research consistently demonstrates the negative effect of anxiety on academic tasks, particularly when those tasks are considered relatively challenging (Eysenck, 1982). As such, the Processing Efficiency Theory (PET) has been put forth as a potential link between anxiety and performance on academic tasks (Eysenck & Calvo, 1992; Owens, Stevenson, Norgate, & Hadwin, 2008). The proponents of PET indicate that state anxiety is more likely responsible than trait anxiety for the manifested performance deficits on academic tasks. State anxiety is believed to be "determined interactively by trait anxiety and by situational threat or stress" (Eysenck & Calvo, 1992, p. 414). However, the authors note the complexity of differentiating state from trait anxiety due to the high correlation between the two. Nonetheless, PET describes worry or worrisome thoughts (like those associated with social anxiety) as being a critical cognitive element effecting task performance. Worrisome thoughts disrupt the functioning of working memory by placing demands on the limited cognitive resources available for processing and storage. When those resources are allocated to dealing with worrisome thoughts, they are less available for performing complex cognitive tasks. Cognitive tasks that place the heaviest demands on the central executive and phonological loop are also those that are most likely to be affected by anxiety (Eysenck & Calvo, 1992; Owens, et al., 2008).

To date, empirical studies support PET's tenet that it is the demands on working memory that cause anxiety-related performance deficits (Derakshan & Eysenck, 1998; Hadwin, Brogan, & Stevenson, 2005; MacLeod & Donnellan, 1993) and performance deficits that result from anxiety impair verbal more so than spatial tasks (Hadwin, et al, 2005; Markham & Darke, 1991; Owens, et al., 2008). However, research has not explored the effect of anxiety on verbal academic tasks of differential cognitive demands, such as reading fluency and reading comprehension.

Implications for Measurement

The current political and social climate in the United States is placing greater demands on schools to be accountable for students' academic success and outcomes. As such, schools have responded to this demand for greater accountability with increased measurement of students' academic gains in order to demonstrate the effectiveness of their practices/curricula. Although educational measurement is undertaken to evaluate school's efficacy, "real accountability" is frequently passed down to the students in the form of negative consequences for failing to demonstrate achievement deemed appropriate by school administrators and political figures. Hence, the concept of high-stakes testing is formed, with high-stakes consequences for schools and for students, including grade retention based on test performance despite adequate classroom performance, being grouped into low-performing clusters for intensive intervention in one or more academic areas while missing other classroom/school content, or being subjected to evaluation for special education eligibility.

Such consequences are likely to differentially plague students experiencing acute anxiety. Aside from high-stakes standardized assessments, a popular form of progress monitoring in schools is curriculum-based measurement (CBM). Although many academic areas may be assessed with CBM, reading measurement has become widely used by schools striving to meet accountability standards and address student academic needs. CBM of reading fluency often consists of requiring students to read aloud a series of short passages in one-minute increments. Students are penalized for missing words or hesitations of more than three seconds. Additionally, reading comprehension is assessed by asking follow-up comprehension questions about the material read. Students with acute anxiety may perform poorly on these tasks due to the aforementioned restriction of working memory rather than any skill deficit. Thus, students may be subject to adverse academic consequences based on measurement that is adversely affected by anxiety. Additionally, after an unsuccessful reading performance, students' anxiety may compound and adversely affect performance on other academic tasks.

Purpose

The purpose of the current study is to examine the relationship between anxiety and task performance on measures of reading fluency and reading comprehension. Published research suggests that the acute anxiety has a negative effect on academic performance (Berg, 1992; Bonifacci, Candria, & Contento, 2008; Gumora & Arsenio, 2002; Kessler, et al, 1995; Last & Strauss, 1990; Markham & Darke, 1991; Minnaert, 1999; Owayed El-Anzi, 2005; Sellers, 2000; Van Ameringen, et al, 2003). Additionally,

the literature suggests a cognitive processing distinction between reading fluency and reading comprehension (Adlof, Catts, & Little, 2006; Hudson, et. al, 2009; Perfetti, 1985; Schwanenflugal, et. al, 2006). Based on the integration of these two areas of research and the findings associated with the PET, it was believed that the significant working memory demands of reading comprehension would yield a negative correlation between anxiety and reading comprehension that would not exist between anxiety and reading fluency because the process is more cognitively automated thereby reducing working memory demands (hypothesis 1). Furthermore, it was hypothesized that students with low anxiety would evidence significantly stronger reading comprehension than students with high anxiety, yet there should be no difference in the reading fluency scores of those with low and with high levels of anxiety (hypothesis 2). Finally, supplementary analyses would investigate the relationship between social anxiety scores and state anxiety scores concerning the process of reading aloud.

Method

Participants

Consent was sought for all fourth, fifth, and sixth grade students within a small, Midwestern elementary school. Parental consent and student assent was obtained from 42 students who served as participants in the study. The sample consisted of 27 Caucasian girls and 15 Caucasian boys in the fourth (n = 14), fifth (n = 11), and sixth (n = 17) grades. The lack of racial/ethnic diversity in the sample is due to the limited racial/ethnic diversity throughout the school. All of the students in the sample were placed in general education classes for reading. Throughout the school, approximately 40% of students qualified for free or reduced lunch, though it is not known what portion of the sample qualified for free or reduced lunch.

Measures

Dynamic Indicators of Basic Early Literacy. Dynamic Indicators of Basic Early Literacy (DIBELS) is an individually administered, standardized, curriculum-based measure of early literacy development. Within DIBELS, the oral reading fluency (ORF) task is a measure of students' accuracy and fluency with reading text aloud based on the number of words read correctly per minute (WCPM) (Official DIBELS home page, 2008). Participants read three one-minute passages based on their current grade level, and their ORF was based on the median WCPM across the three passages. The combined item-stability estimate for ORF is .94, and it correlates .36 with the Reading Cluster of the Woodcock-Johnson.

Woodcock-Johnson Test of Achievement, 3rd Edition. The students were administered the passage comprehension subtest from the Woodcock-Johnson Test of Achievement, 3rd Edition (WJ-III) as a measure of their reading comprehension skill. The median reliability for the passage comprehension subtest is .83 for students aged 5 to 19 (Mather & Woodcock, 2001). The passage comprehension component of the WJ-III is a cloze procedure in which the student identifies an appropriate term for a blank within the passage. Thus, selecting a key missing word demonstrates his/her comprehension of the text. The administration of this subtest took approximately 10 minutes per participant.

Social Phobia and Anxiety Inventory for Children. The Social Phobia and Anxiety Inventory for Children (SPAI-C) assesses somatic, cognitive, and behavioral aspects of social phobia and the frequency and range of social fears and anxiety in children. Items are formed on a 3-point Likert scale and address how nervous or scared an individual feels in various situations (Beidel, Turner, & Morris, 1998). The 26 descriptions of situations were read aloud to groups of participants, and participants rated how frequently they felt scared or nervous in those situations. The manual reports the overall alpha coefficient for the SPAI-C is .92 (Allen, 1998). Scores can range from 0 – 52 with higher scores more indicative of social phobia. Since the study was examining social anxiety rather than social phobia, the manual suggests using only items 1-5, 16, and 17. Thus, analyses for research purposes were based on these items rather than the overall SPAI-C score. The overall coefficient alpha for the SPAI-C with the current sample was .88. The manual recommends a cutoff score of 18 for social anxiety (Beidel, et al, 1998). Thus, those participants with scores of 18+ were classified in the high anxiety group, and those with scores less than 18 were considered low anxiety in the current research. The administration of the SPAI-C took approximately 20 minutes per group of participants.

State Anxiety Assessment. To assess state anxiety concerning the process of reading aloud, students responded to two follow-up questions using a Likert scale with 1-"not nervous at all," 2-"slightly nervous," 3- "pretty nervous," or 4- "extremely nervous." The questions were as follows: "How nervous were you when reading aloud to me?" and "How nervous are you when you speak in front of the class or group of students?" A third question asked, "How do you feel when you read silently by yourself?" The response choices for this question were 1-"I love to read," 2- "I like reading sometimes," 3- "I read when I have to," or 4- "I hate reading."

Procedures

Examiners in the study were advanced graduate students in school psychology who were trained in psychoeducational assessment through multiple graduate courses within their curriculum. The examiners individually administered the ORF task and the WJ-III passage comprehension subtest to each participant. Administration of the ORF task and the passage comprehension subtest were counterbalanced to control for order effects. Immediately upon completion of the reading comprehension measure, examiners assessed each participant's state anxiety with the aforementioned questions. A researcher then group administered the SPAI-C in the participants' classrooms. The SPAI-C items were read aloud to participants to insure adequate understanding. Students who did not have permission to participate in the study were moved to another room for an alternate activity during the administration of the SPAI-C.

Analyses

To address hypothesis 1, correlations were used to determine the relationship between anxiety scores on the SPAI –C and the measures of reading comprehension and reading fluency. To address hypothesis 2, a one way analysis of variance (ANOVA) was conducted to determine if there were significant differences between the reading fluency and reading comprehension mean scores of students classified as having low and high levels of anxiety. In the case of statistically significant results, effect sizes were conducted. Finally, Spearman's rho correlations were used to explore the relationship

between social anxiety scores on the SPAI-C and state anxiety scores from the follow-up questions concerning the process of reading aloud.

Results

Social anxiety and Reading Measures

Hypothesis 1 predicted that the significant working memory demands of reading comprehension would yield a negative correlation between anxiety and reading comprehension that would not exist between anxiety and reading fluency. The hypothesis addressed the relationship between participants' performance on measures of reading fluency (ORF) and reading comprehension (WJ-III passage comprehension) tasks as a function of their assessed social anxiety. Hypothesis 1 was supported with a significant negative correlation between social anxiety scores and reading comprehension scores, $r(41) = -.39$, $p = .01$, which indicates that as anxiety scores increase, reading comprehension scores decrease. This accounts for 15.2% of the variance. Also as expected, there was no significant relationship between social anxiety scores and reading fluency scores, $r(41) = -.13$, $p = .40$. Hypothesis 2 asked whether there was significantly different reading fluency and reading comprehension scores between students with high and low social anxiety. It was predicted that students with low social anxiety would perform significantly better than students with high anxiety on measures of reading comprehension but not measures of reading fluency. Hypothesis 2 also was supported, and the Levene's test for homogeneity of variance was nonsignificant indicating appropriate analysis with the ANOVA. Students' reading comprehension performance was significantly different between students with low ($M = 94.62$, $SD = 6.77$, $n = 29$) and high ($M = 89.85$, $SD = 6.87$, $n = 13$) levels of social anxiety, $F(1, 40) = 4.43$, $p = .04$. The effect size of the finding is .33 (Cohen's $d = .70$). No significant difference was found in reading fluency performance between students with low ($M = 124.69$; $SD = 35.13$) and high (117.23, $SD = 40.69$) levels of social anxiety, $F(1,40) = .37$, $p = .55$.

Social Anxiety and State Anxiety

Social anxiety scores were correlated with state anxiety questions concerning the process of reading aloud. There was a significant correlation with question 2 (How nervous are you when you speak in front of the class or group of students?), $r_s(41) = .47$, $p = .002$, representing 25% shared variance. This question addresses how nervous the participant feels when speaking in front of a group. Question 2 was also significantly negatively correlated with reading comprehension score, $r_s(41) = -.35$, $p = .02$. This indicates that students who are more nervous as they speak in front of the class or group of students tend to have lower reading comprehension scores.

Discussion

The present study investigated the relationship between anxiety and the measurement of reading fluency and reading comprehension. The importance of this line of research lies in its theoretical and practical application. In addition to providing

support for the PET, the results of this research offer teachers, school psychologists, and other school personnel interpretive insight for their measurement of students' reading achievement. As previously discussed, serious academic decisions are often based on the findings of read aloud measurements in the classroom. As such, it is critical that those making the decisions have relevant information to interpret the results with validity. In fact, educators should take into account the effect of anxiety on reading performance (specifically reading comprehension) which may cause a performance deficit to appear as a skill deficit on the aforementioned measurement.

Previous research had demonstrated support for a reciprocal relationship between reading fluency and reading comprehension. Specifically, as fluency improves more cognitive resources are available to devote to comprehension (i.e., simple reading fluency model), thereby improving that skill as well (Fuchs, et al, 2001; Hudson, et al, 2009; Schwanenflugel, Meisinger, Wisenbaker, Kuhn, Strauss, & Morris, 2006). In addition, other lines of research suggest that anxiety has a detrimental effect on school performance due to the heavy demands that worrisome, interfering thoughts make on working memory (Markham & Darke, 1991). According to PET, anxiety is likely to have the most effect on cognitively challenging tasks that require significant working memory capacity (Eysenck, 1982). Thus, the findings of the current study integrate these lines of research. The present research found that there is a significant negative correlation between social anxiety and reading comprehension but no significant correlation between social anxiety and reading fluency. This supports the simple reading fluency model and aligns with the tenets of PET in that more complex tasks are more likely affected by anxiety. Providing additional support, those participants with low social anxiety had significantly higher reading comprehension scores than those with high social anxiety. There were no differences in reading fluency scores of those in low and high anxiety groups. The finding from the present study supporting a correlation between social and state anxiety is similar to other research (e.g., Eysenck & Calvo, 1992) and supports the validity of the other findings from the present study.

Conclusions and Recommendations

Perhaps the most critical implication of the research is that to the classroom student. This research supports that when educators use read aloud measures to assess reading comprehension skills, a purely score-based interpretation may be grossly inaccurate for a significant number of students who are experiencing social anxiety or simply state anxiety. For those students, the restriction of working memory caused by the anxiety will often lead to performance that is not reflective of their true reading achievement. The results will represent a performance deficit rather than a skill deficit, and thus, the intervention/consequences will be inappropriate to garner student success. In fact, receiving the academic consequences resulting from the measurement will likely serve to increase the individual's anxiety and impair the validity of future skill measurement.

Due to the correlational nature of the present study, the exact etiology of the participants' anxiety cannot be determined. It is not known whether previously existing academic skill deficits may have led to the measured social and/or state anxiety thereby impairing performance. However, considering that reading fluency and reading

comprehension are highly correlated, and the fact that reading fluency appeared relatively unaffected by the anxiety, it seems unlikely that the source of the anxiety was a reading comprehension skill deficit. Regardless of the etiology and/or manifestation of anxiety, the present research supports that educators need to take into account levels of student anxiety when interpreting measurement results and determine its possible effect, particularly in the area of reading comprehension. Given these findings using multiple measures for reading comprehension and using caution in interpretation seem appropriate courses of action for measurement with students who may be experiencing symptoms of anxiety.

Currently, the reading measures upon which decisions are based are given in the classroom by individuals who have been trained to give the measures (e.g., classroom teachers, teachers' aides, reading specialists, or special education teachers). While these examiners are often versed in administering the instruments, many have not received training in thorough diagnostic assessment and interpretation. Thus, the results are frequently subject to only score-based evaluation versus true interpretation based on factors observable during the measurement such as effort, persistence, and anxiety. Based on the current findings regarding the effect of anxiety on measurement of reading, it stands to reason that the process of evaluating reading results should move from one of measurement to one of assessment similar to the manner that school psychologists use background information and behavioral observations in their interpretation of standardized cognitive assessment results.

Limitations of the current study include the fact that much of the research is correlational in nature, and thus, results should not be interpreted as causal. In addition, the small demographically and geographically limited sample may not be representative of the larger population. The sample also contained more girls than boys, and gender was not investigated in this research. Additionally, grade level was not addressed in the present research. Future research may begin to address the aforementioned limitations. Longitudinal research would allow more insight into the etiology of students' anxiety and provide information regarding the level of anxiety that begins to yield detrimental academic performance. Additionally, research into the effect of anxiety on the measurement of other academic areas (e.g., mathematics or writing) would likely provide further interpretive insight for classroom measurement.

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