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Improving Expository Reading Comprehension in College Students

Danielle M. De Lucia
Virginia Consortium Program in Clinical Psychology

George Noell
Department of Psychology, Old Dominion University

This study investigated the impact of the Collaborative Strategic Reading (CSR) method on reading comprehension and psychological well-being among college students, addressing a gap in research on expository reading comprehension at the post-secondary level. A total of 47 students from Introduction to Psychology courses participated in the study. Participants initially completed pre-test assessments, including a cloze test, the Wide Range Achievement Test, and scales for self-worth, depression, anxiety, and stress. Of these, 23 students underwent CSR intervention sessions, conducted over three weeks with bi-weekly 50-minute sessions using their course textbook. Post-intervention data from 44 students were analyzed using repeated-measures ANOVA. Results indicated no significant mean differences on the variables of interest among individuals who received CSR intervention and those who did not.

Keywords: reading comprehension, college students, Collaborative Strategic Reading

Nationally, only 62.3% of college freshmen graduate within six years of initiating undergraduate studies (Completing College National and State Reports, 2022). Although approximately 80% of high school students report plans to complete a bachelor's degree, a large portion of these young adults are not prepared to start college. Roughly one third of graduating high school students are ill-prepared to complete a college level English course (Readiness Matters, 2013). Accordingly, this finding suggests graduating high school students' writing and literacy skills are below college level, which may contribute to students terminating college/university studies prematurely or failing courses. Of note, and relatedly, a lack of college readiness reduces the number of skilled and productive workers in the workforce and frustrates many young adults' career goals (Readiness Matters, 2013). These findings suggest that teaching entering undergraduate students how to better comprehend expository text (i.e., empirical journal articles, textbooks, and course readings) may lead to better academic and personal outcomes.

Understanding how to better teach reading comprehension to undergraduates may give educators more insight into how to aid the development of reading comprehension more broadly in adults. Research shows that one hundred and thirty million Americans between the ages of 16 and 74 read at below a sixth-grade level (Barbara Bush Foundation for Family Literacy, 2003). Approximately 52% of US adults have low-level reading skills, and 21% of US adults struggle to read (U.S. Department of Education, National Center for Education Statistics, 2019). Adults with low literacy skills have higher rates of unemployment and tend to be passed over for occupational promotions (Literacy Pittsburgh, 2023). By the time adolescent students reach high school, most can be taught to comprehend expository texts. Expository texts are non-fiction reading material that include facts or information about a topic (Weaver & Kintsch, 1991). Expository reading materials make up most readings assigned in college, especially in scientific fields of study. However, young adults often realize they lack crucial literacy skills, such as reading comprehension and synthesis once they enter post-secondary education. Twenty percent of first-year college students have basic or below quantitative literacy skills, which is defined as the ability to extrapolate numbers or computations embedded in printed materials (National Survey of America's College Students, 2006). This finding implies that approximately one-fifth of students who enroll in four-year universities might not be adequately prepared for the reading demands of scientific texts at a college level.

The research examining college students' reading comprehension is limited. Prior research has focused on the reading comprehension strategies college students use rather than their degree of comprehension. A study conducted by Taraban et al. (2000) examined how reading strategies used by college students are related to academic performance. The researchers asked students what types of reading strategies they used regularly and their current grade point average (GPA). They found that students who reported using more varied reading strategies also tended to have higher GPAs. An important limitation of this study was that participants self-reported their reading strategy use. As a result, it is unknown the extent to which self-reports match student use of multiple reading strategies, versus a self-reporting bias to report more academic engagement among higher achieving students. Kolic-Vehovec et al. (2011) further explored how types of reading strategies affect academic achievement by directly measuring what reading comprehension strategies undergraduate participants used. The researchers found that undergraduate students who exhibited poor reading comprehension used few comprehension strategies to build a global understanding of academic text. The researchers also found that the impacts of reading strategies on students' academic achievement (i.e., GPA) were influenced by reading comprehension. This was assessed by having participants answer five short answer questions on three complex texts that were adapted from scientific papers Results indicated that students using reading strategies such as bridging inferences, elaborations, question generation, and summary integration tended to have better reading comprehension and academic performance than students who did not use any reading strategy techniques. That is, reading comprehension is a foundational skill for success in college.

Furthermore, research has found that successful reading comprehension for university students is achieved through various reading strategies, where the use of more strategies translates to a higher degree of success (Magliano et al., 2023). Research has also examined which strategies are most effective. Multiple studies have found that students who use bridging and elaborative inferences demonstrate better reading comprehension (Feller et al., 2020; Kolic-Vehovec et al., 2011). Bridging inferences are used to build connections between main ideas within a text. Elaborative inferences consist of students expanding on main ideas in their own words. Students who struggle with reading comprehension tend not to use these strategies. One study involving 112 undergraduates assessed what types of text comprehension strategies good comprehenders use when reading scientific topics. The researchers found that good comprehenders use strategies that build a global representation of the text, such as elaboration and summarizing strategies (Kolic-Vehovec et al., 2011). Researchers also analyzed reading strategies with various text types. Bridging inferences predicted success on Reading Strategies Assessment Tool (RSAT), aiding in problem-solving during higher-level reading processes. Elaborative inferences were predictive of a positive performance on scenario-based assessments (Feller et al., 2020). Magliano and colleagues (2023) examined college students who were underprepared for the literacy demands in college coursework. The researchers found that students who struggled with bridging and elaborative inferences tended to be assigned to developmental literacy programs in college. Overall, these findings suggest that as students enter college, bridging and elaborative inference techniques may be key components in understanding complex academic texts.

Building on the research describing the behavior of successful students, work has also emerged focusing on how to improve college students' reading comprehension for scientific texts. Research has demonstrated that students who can summarize information in their own words and connect information from

previous knowledge display better comprehension of overarching themes and main ideas component to such texts (Linderholm et al., 2014). In essence, this finding suggests that a student's ability to connect information and explain main ideas in their own words is associated with increased reading comprehension. Research has also examined how text features (e.g., cohesion), individual differences in reading skill, and prior knowledge, may influence expository reading comprehension. Findings indicate that prior background knowledge of the reading materials improves reading comprehension for college students (Ozuru et al., 2009). Lenox and colleagues (2020) studied undergraduate students' reading strategies for primary scientific literature. Their results indicated that students tend to prioritize reading text-heavy sections of papers, while avoiding the numerical data portions of the text. The researchers suggest that students may lack the technical skills to connect numerical and text-based information in scientific literature. Like those previously cited, this finding supports the notion that poor quantitative literacy is pervasive among college freshmen (National Survey of America's College Students, 2006). Based on this study, texts that are more expository, technical, and less narrative in structure are more challenging for college students, who must incorporate written and numerical data to properly comprehend scientific texts. The current research literature on reading comprehension in college students is limited, which is surprising given the crucial role reading comprehension plays in secondary education. Given the identified academic challenges, it becomes imperative to delve deeper into understanding how reading comprehension not only affects educational outcomes but also broader cognitive and emotional experiences, such as academic self-worth. This transition is particularly significant because the cognitive demands of comprehending complex, technical texts may directly influence students' academic self-perception and confidence levels.

Academic Self-Worth

As students transition to higher education, students encounter a more rigorous academic environment characterized by complex critical thinking tasks, extensive reading assignments, and the expectation for independent learning. These increased academic demands require students to engage not only in deeper analytical reasoning but also in the synthesis of multifaceted information across diverse subjects. Such demands significantly intensify cognitive load and can exacerbate stress, particularly if students overestimate their reading comprehension abilities and are ill-prepared for the complexity of higher education materials (Lennox et al., 2020). Thus, reading college materials can be a new and frustrating experience for undergraduate students. Even students labeled good readers (i.e., able to read at higher comprehension levels and synthesize complex reading materials) may need help with their reading skills, especially when associated material is advanced, technical, including numerical data, or draws on new knowledge domains (Kolic-Vehovec et al., 2011). Of importance, struggling to understand college reading materials may negatively affect a student's sense of academic self-worth. Academic self-worth emerges when students view their schoolwork as a demonstration of their intelligence and use these successes as a source of self-validation (Crocker & Knight, 2005). Individuals whose self-esteem is contingent on academic achievement are likely to experience diminished self-worth when they encounter academic difficulties, such as receiving poor grades (Crocker et al., 2006). Consistent with this pattern, Crocker et al. (2003) investigated the extent to which grades shaped the self-worth of college students majoring in engineering or psychology. They asked participants to complete the contingencies of self-worth scale (Crocker & Luhtanen, 2003), a global self-esteem measure, and measures of depression three times a week for three weeks, as well as after receiving grades from an exam or paper. The study demonstrated that students whose self-worth was dependent on academics were especially affected by poor grades. Results also indicated that poor grades had a stronger impact on participants self-worth than receiving good grades, and that negative feedback had a stronger impact than positive feedback. Prior research has demonstrated that low literacy skills in adults are associated with poor mental health outcomes such as depression, stress, and anxiety (Hunn et al., 2023). One goal of the current research is to examine whether improving reading comprehension will enhance academic self-worth in college students.

Collaborative Strategic Reading

Collaborative Strategic Reading (CSR) is an intervention consisting of four comprehension strategies that are used before, during, and after reading to help students comprehend text. Component strategies include: (1) Previewing the Text; (2) Click and Clunk; (3) Get the Gist; and (4) Wrapping Up (Klinger & Vaughn, 2000). Previewing the text is freely scanning the reading material (i.e. looking at headers, images, and bolded text) to search for context clues that may inform the reader of the main idea of the passage. Previewing the text is done before a student starts reading; it is designed for the student to activate prior knowledge and have the students make predictions about the text. Click and Clunk is a self-monitoring strategy used during reading that helps readers monitor their comprehension or the reading materials. Click means that the reader is comprehending the text. Clunk means that there is a part of the text that the reader is struggling to comprehend. The purpose of click and clunk is to help students develop strategies to work through text or words they do not understand. If the student does not understand the text, they will follow up with three Fix-up strategies. The first fix up strategy is Vocabulary Fix-Up Skills, which involves the student looking for clues in a sentence to understand the meaning of unknown vocabulary words. The second fix up strategy is Read-Pause-Reflect, which helps students understand the main idea for each section of reading by asking them to pause and recall information or reread sections. The third fix-up strategy is Partner Retell, during which students work in pairs, with one student retelling the main concepts of the text and the other listening. This fist portion of this strategy is tantamount to summarizing in the reader's own words, as previously described. The listener then re-shares the main concepts back to the other student. Get the Gist helps students identify the key details or main ideas of text sections.

Specifically, students read a large section of text and identify the *who* or *what* of the reading, then write down a concise sentence about the reading. Wrapping Up occurs after the students finish reading the entire text, at which point they identify the main points of the reading (Klinger & Vaughn, 2000).

The CSR model was originally developed by Brown et al. (1984) to help seventh grade students struggling with reading comprehension. The researchers found that the collaborative nature of CSR helped model ways for students to meaningfully engage in reading. They also found that using the CSR model promoted significant reading comprehension gains, as well as maintenance over time. The effects of CSR have been examined with several populations, including middle school students. Vaughn et al. (2011) conducted a study in which 61 seventh and eighth grade Language Arts classrooms were randomly assigned to the CSR intervention group or the business-as-usual control group. Students were given multiple pre-test measures of reading comprehension including the Gates-MacGinitie Reading Test (Gates & MacGinitie, 2000), AIMSweb Reading Curriculum Based Measure (Howe & Shinn, 2002), Metacomprehension Strategy Index (Schmitt, 1988), Test of Word Reading Efficiency (Torgesen et al., 1999), and Test of Silent Reading Efficiency and Comprehension (Wagner et al., 2010). The study took place over an 18-week period with students receiving two sessions per week, after which students were given the same measures at post-test. Findings indicated there was a significant difference in reading comprehension scores between the treatment and control group ($Dx^2 = 9.91$, $p = .002$). Students in the CSR treatment group significantly outperformed students in the control classes on the Gates-MacGinitie Reading Test (Gates & MacGinitie, 2000) reading measures.

Encouragingly, prior research has found CSR to be effective instructional method for a range of students, including those characterized as low, average, and high achieving, as well as those with learning disabilities (Klinger et al., 2004). Moreover, CSR has been identified as beneficial to students at all levels of reading achievement specifically, as well as participants with an identified specific reading disability and typically developing. Vaughn et al. (2015) conducted a two-year randomized control trial providing CSR to high school students with reading problems. The study used augmented CSR with additional reading strategies provided to the intervention group to help improve ninth and tenth grade students' reading comprehension in social studies. Students in the intervention group exhibited significant improvements in reading comprehension. Another study examined the long-term effects of CSR with middle school students and whether CSR reduced achievement gaps between low- and middle-income students. The study took place over two years and found that CSR significantly improved reading comprehension. Moreover, results indicated that students from low-income homes improved reading comprehension at a faster rate than their non-low-income peers (Buckley & Boardman, 2014). This wide range of effectiveness is particularly encouraging in the context of the current study, as it suggests the potential efficacy of CSR for diverse, young adult readers.

A review of literature identified only one prior study by Grandstaff-Beckers (2006), which extended CSR to a college population. A subsequent secondary analysis by Grandstaff-Beckers et al. (2013) used data from the original study to examine treatment fidelity and its effects on reading comprehension among freshman male college athletes. The purpose of the study was to determine the effectiveness of CSR for expository text in first-year college students. The study included sixteen first-year male college student athletes who were randomly assigned to the experimental or control condition. The experimental group received CSR instruction in addition to the standard study skills enhancement from the university's academic center. The control group received the standard study skills enhancement from the university's academic center. The Gates-MacGinitie Reading Test – Adult Reading, 4th Edition (GMRT-4; Gates & MacGinitie, 2000) was used to measure the participants' reading comprehension skills pre- and post-test. To directly study expository test reading comprehension levels, the Qualitative Reading Inventory-4 (QRI-4; Leslie & Caldwell, 2006) was used pre- and post-test. The researchers found that CSR was implemented with high fidelity and students in the CSR group demonstrated significant improvement in reading comprehension for expository text on the GMRT-4 (Grandstaff-Beckers et al., 2013).

Present Study

There is limited research examining the prevalence of reading comprehension issues among college students. Studies examining methods to improve reading comprehension in the undergraduate population, in addition to how reading comprehension difficulties affect students' self-worth, are particularly rare. Existing research has focused primarily on creating interventions to improve reading for elementary and early middle school-aged children (Brown et al., 1984; Vaughn et al., 2015; Vaughn et al., 2011). The current study aimed to test an intervention designed to improve college students' reading comprehension for college-level scientific expository texts. Another aim was to examine whether improving reading comprehension would increase participants' academic self-worth. Researchers hypothesized that the reading comprehension intervention would increase students' post-test reading comprehension and that improvement in reading comprehension would enhance students' sense of academic self-worth.

Method

Participants

The study recruited 47 undergraduate college students at a southeastern university enrolled in Introduction to Psychology courses. The study was advertised across multiple course sections. A priori power analysis was performed using G*Power (Faul et al., 2007) to estimate the required sample size. With a significance criterion of $\alpha = .05$ and power of .80, the sample size needed to detect an effect size of 0.40 was found to be $n = 44$ for an

analysis of covariance). An effect size of 0.40 has been described as a medium effect size using Hedges' *g* criteria (Faul et al., 2007). Participants were randomly assigned to the intervention group or the waitlist control group. Participants in the waitlist control group were offered the opportunity to receive the intervention after the treatment group. The study was approved by the university's Institutional Review Board (IRB). Participants received SONA credit for participation in the study.

Measures

Reading Comprehension

The Cloze test is an objective measure of reading comprehension that requires readers to fill in missing words in a passage (Templeton, 1977). The current study used the maze Cloze measure. The reader was required to select the missing word from a word bank (Van Dijk & Kintsch, 1983). Mazes are recognized as a universal assessment tool for reading proficiency, as they necessitate the application of decoding, fluency, and comprehension skills (Fuchs et al., 1992). The maze cloze measure was selected for this study because prior research shows that maze cloze tasks are stronger predictors of silent reading performance than traditional open-ended cloze tests in college students (Williams et al., 2011). In addition, meta-analytic evidence indicates that cloze tasks demonstrate moderate to strong correlations with adult reading comprehension, supporting their validity for use with college readers (Leachman et al., 2025). The Cloze test demonstrated excellent internal consistency (e.g., Cronbach's alpha of .92; Gellert & Elbro, 2013). Previous research has shown that the cloze test correlates well (r =.52–.68) with other measures of reading comprehension including a maze task and the reading comprehension and vocabulary subtests on Nelson-Denny Reading Test – Form H (Brown, 1993) in college populations (Williams et al., 2011). The maze Cloze passages used in this study were developed from expository text using a college-level introductory psychology textbook not used in the course the participants were enrolled during the study. The passage was missing every seventh word, and participants were furnished with a word bank of possible answers Following the fixed-ratio cloze tradition (Taylor, 1953; Bormuth, 1968; Brown, 2013), an every-7th-word deletion interval was selected. Brown (2013) indicates that studies have used deletion frequencies at the 5th, 7th and 9th word intervals, supporting the choice of 7th as a methodologically sound compromise between difficulty and text coherence. Participants had five minutes to fill in as many missing words as possible.

Wide Range Achievement Test, Fifth Edition (WRAT-5; Wilkinson & Robertson, 2017) is an objective measure of academic achievement. The current study used the Word Reading and Sentence Comprehension Subtests to measure participants academic reading skills. The WRAT-5 was used as a descriptive measure. Research has demonstrated that the WRAT-5 Word Reading subtests demonstrated excellent (.94) internal consistency. Intercorrelation studies conducted using the WRAT demonstrated high correlations (r = .92). The WRAT-5 demonstrates moderate (r = .79) correlation with Weschler's Individual Achievement III (WIAT-III; Wilkinson & Robertson, 2017).

Academic Self-Worth

The Contingencies of Self-Worth Scale (CSWS; Crocker & Luhtanen, 2003) was used to assess participants' academic, as well as other areas of self-worth. The CSWS is 35 item self-report questionnaire measuring seven different domains of self-worth: family support (a =.84), competition (α =.88), appearance (α =.83), God's love (α =.96), academic competence (α =.79), virtue (α =.83), and other's approval (α =.81). The questions are asked on a 7-point Likert scale ranging from *strongly disagree* to *strongly agree*. The CSWS has demonstrated good internal consistency for each domain. The test-retest reliability ranged from .51–.88 (Crocker & Luhtanen, 2003). The CSWS demonstrated good construct validity when compared to other measures of self-worth indicating that it is measuring domains of self-worth. It also has been shown to have discriminant validity, indicating that each domain of the CSWS is distinct (Crocker et al., 2003).

Intervention

College students were taught to improve reading comprehension of expository text using CSR. Each lesson was allocated 45 minutes, twice per week for four weeks, for a total of six hours of intervention. Eight scripted lessons on reading comprehension for expository text were created from the Klinger and colleagues (2001) manual *Collaborative Strategic Reading* for each session. Each lesson included the four major reading strategies used in CSR, (1) Previewing the Text; (2) Click and Clunk; (3) Get the Gist with Fix-Up Strategies; and (4) Wrapping Up. The researcher incorporated the four reading strategies using three phases of scaffolded instruction. First, the researcher used teacher modeling, which involved the researcher demonstrating each reading comprehension strategy. Second, the researcher used guided practice in which the student demonstrated the technique while describing the procedure as the teacher provided feedback. Third, the researcher had the students work independently on the strategies with limited guidance, but with the session instructor available to answer questions and provide feedback. A CSR learning log comprising each of the CSR strategies was included to help participants write down information as they progressed through the lessons. During each phase of the CSR lesson, the participants were instructed to record information, including the content they were reading, any questions they had, summaries of the reading, and words or sections of the text that they found challenging.

Participants met with the researcher at a consistent time in either the morning, afternoon, or evening. Experimental sessions were conducted in groups. The intervention groups ranged from 14 to 8 participant per group. The control groups were smaller on average ranging from 8–4 participants per group with evenings having the smallest groups. During each session the researcher presented the topic and chapter for that lesson. Topics were introduced sequentially. The CSR comprehension strategies were

used before, during, and after reading to increase text engagement and reading comprehension. The first phase of training focused on Previewing. This began with the researcher presenting the chapter and key vocabulary terms, then demonstrating previewing by asking participants about their prior knowledge of on section of the chapter. Next, participants completed their learning logs before moving on to another section of the chapter. The following set of lessons focused on the reading phase, which included the Click and Clunk and Get the Gist lessons. For the Click and Clunk activities, participants were asked to read a portion of the assigned chapter and monitor their understanding of the text and implement the Fix-Up strategies when they were struggling with comprehension. In the Get the Gist phase, participants first read through a section of the assigned chapter and then wrote a short summary of the material in their learning logs. The last set of lessons focused on the after-reading activities, which included the Wrapping Up lessons. Participants were asked to read a portion of their chapter and implement all the previous CSR lessons. After they finished reading, they were asked to generate discussion questions about the text and review the key ideas of the reading.

Table 1. Cloze Pre-test passages BCF

Passage	Intervention group			Control group		
	N	*M*	%	*N*	*M*	%
B	10	7.20	43%	4	8.25	18%
C	10	4.80	43%	6	7.17	27%
F	3	11.00	13%	12	10.33	54%

Table 2. Results of Pre-tests and Post-tests within condition t-test scores

	Intervention group		Control group		*t*(43)	*p*	Cohen's *d*
	M	*SD*	*M*	*SD*			
Pre-test Cloze	6.64	3.68	9.09	4.71	-1.94	.212	.58
Post-test Cloze	9.36	4.82	12.45	6.68	-1.76	.081	.53

Table 3. Results of Pre-tests and Post-tests within condition t-test scores

	Variable	*n*	*M*	*SD*	1	2	3	4	5	6
1.	Pre CSWS Academic Competence	45	5.60	0.93	-					
2.	Pre DASS Stress	45	16.18	9.84	.33	-				
3.	Pre DASS anxiety	45	14.98	9.48	.23	.54**	-			
4.	Pre DASS depression	44	10.59	9.82	.34	.71**	.63**	-		
5.	Pre Cloze passage	45	7.84	4.34	.35	.06	−.24	−.04	-	
6.	Pre WRAT	45	105.47	11.92	.13	.04	−.10	.05	.27	-

Note. * $p < .05$, ** $p < .01$.

If participants missed a lesson, the researcher offered a makeup session before the next lesson date. After the intervention group and post-test measures were collected, the waitlist control group was offered the opportunity to complete the intervention. If participants from the control group chose to complete the CSR intervention, they followed the same structure as the intervention group. Participants in the control group were not required to complete the intervention. Eighteen participants from the waitlist control group completed the CSR intervention.

Procedure

The Cloze test (Templeton, 1977) and the Wide Range Achievement Test, Fifth Edition (WRAT-5; Wilkinson & Robertson, 2017) were used to measure reading comprehension prior to intervention. The WRAT-5 was examined as a potential covariate to control for general reading skills at study onset. The Contingencies of Self-Worth Scale (Crocker & Luhtanen, 2003) was administered to all participants before and after treatment to measure academic self-worth pre-intervention. After the intervention group completed CSR, all the participants administered the Cloze test, WRAT-5, and CSWS post-intervention to assess intervention effects.

Due to logistical constraints, the distribution of cloze passages was not balanced prior to administration. As a result, different forms of the passages were distributed without a systematic randomization protocol. Specifically, passage F was predominantly assigned to the control group, while the other passages were distributed among the treatment groups. This asymmetrical distribution was unintended and occurred due to the lack of randomization in the assignment process.

Assignment

After recruitment, the students were randomly assigned to intervention and waitlist control groups. There were 24 participants randomly assigned to the intervention group and 23 participants randomly assigned to the waitlisted control group. From the waitlisted control group, 18 participants elected to complete the intervention at the conclusion of the wait period. Once the waitlist control group completed the intervention, the same measures were administered.

Results

Pearson product–moment correlations were computed to examine the relationships among the pre-test scores (see Table 3).There was a significant strong positive correlation between pre-test DASS Stress subscale and pre-test DASS Depression subscale ($r = .71$, $p < .01$), as well as between the pre-test DASS Stress subscale and the

pre-test DASS Anxiety subscale (r = .54, p < .01). This indicates that higher levels of stress were associated with more anxiety and depressive symptoms. Similarly, individuals with increased anxiety symptoms also reported higher levels of depression Regarding post-test results, there was a significant strong positive correlation between the post-test DASS Stress subscale and the post-test DASS Depression subscale (r = .81, p < .01), and between the post-test DASS Stress subscale and the post-test DASS Anxiety subscale (r = .78, p < .01). All pre-test DASS subscales were significantly positively correlated with their respective post-test DASS subscales. Pre-test DASS Stress subscale and post-test DASS Stress subscale (r = .66, p < .01), post-test DASS Depression subscale (r = .48, p < .01), and post-test DASS Stress subscale (r = .44, p < .01). Pre-test DASS Anxiety subscale and post-test DASS Stress subscale (r = .56, p < .01), post-test DASS Depression subscale (r = .56, p< .01), and post-test DASS Stress subscale (r = .71, p < .01). Pre-test DASS Depression subscale and post-test DASS Stress subscale (r = .65, p < .01), post-test DASS Depression subscale (r = .71, p < .01), and post-test DASS Stress subscale (r = .52, p < .01). This pattern suggests that participants reporting higher levels of stress, anxiety, or depressive symptoms at pre-test tended to report similarly high levels in these domains at post-test (see Table 4). No other statistically significant correlations were observed at pre-test.

Given the finding that the Cloze (Templeton, 1977) and WRAT-5 (Wilkinson & Robertson, 2017) were not statistically significantly correlated at pre-test, a repeated-measure analysis of variance was conducted (i.e., as opposed to a repeated measures analysis of covariance) to evaluate if the CSR intervention significantly improved reading comprehension at post-test (see Table 5). The analysis did not yield a time by condition interaction, $F(1,42) = 0.09$, $p = .760$. There were main effects for time $F(1, 42) = 8.69$, $p = .005$ and group membership $F(1, 42) = 5.91$, $p = .019$. These main effects indicated that both groups increased Cloze passage scores from pre-test to post-test and that overall, the control group outperformed the CSR group across the two occasions.

To explore the surprising result that the control group outperformed the treatment group as a main effect, the researcher examined the distribution and scores of the alternate Cloze passage forms to assess whether materials may have contributed. At post-test, alternate forms were similarly distributed across conditions, suggesting they were unlikely to account for the finding. However, a frequency analysis of pre-test passages revealed unequal distribution across groups due to random assignment (see Table 1). Specifically, Form F comprised 54% of passages for the control group but only 13% for the treatment group. Form F's mean score was approximately four points higher than other forms, raising a potential concern. Although pretest group differences were not statistically significant, $t(43), -1.94$, $p = .212$, 95% CI [−4.97, .09] (see Table 2), the trend aligns with the unequal form distribution. It is important to note that passage forms were not preemptively balanced across groups, which could influence group comparisons. While observed differences are reported, caution is warranted in interpreting these results, as unequal allocation of materials may have introduced a small systematic bias.

Discussion

The current study did not find a statistically significant condition x time interaction effect for the CSR intervention on post-test reading comprehension scores when analyzed in the repeated measures ANOVA. In a study by Grandstaff-Beckers et al. (2013) that closely parallels the current research, they examined the impact of CSR on improving reading comprehension in underprepared college student athletes enrolled in an academic support center, finding a significant improvement in reading comprehension skills at post-test. Although there are several possible explanations for our failure to replicate said findings, one possible explanation is that the prior study used a specific population which was students who were enrolled in an academic support center. In contrast, the current study was open to any student enrolled in an introductory psychology course. It is also possible that the failure to obtain statistically significant interaction effects was the result of having many participants with strong reading skills who were unable to improve reading skills acquisition from the intervention. Participants may not have shown substantial gains because their pre-test scores were already near the maximum, suggesting a

Table 4. Descriptive Statistics and Pearson correlation Pre-test and Post-test DASS Scales

	Scales	*n*	*M*	*SD*	1	2	3	4	5	6
1.	Pre DASS Stress	45	16.18	9.84	-					
2.	Pre DASS Anxiety	45	14.98	9.48	.54**	-				
3.	Pre DASS Depression	44	10.59	9.82	.71**	.63**	-			
4.	Post DASS Stress	44	15.86	10.47	.66**	.56**	.65**	-		
5.	Post DASS Anxiety	44	12.50	10.16	.44**	.71**	.52**	.78**	-	
6.	Post DASS Depression	44	10.77	10.51	.48**	.56**	.71**	.81**	.84**	-

Note. * p < .05, ** p < .01.

Table 5. Means, Standard Deviations, and Repeated Measure One-way Analyses of Variance for the Collaborative Strategic Reading Intervention

Measure	Intervention group		Control group		*F(1,42)*	η^2
	M	*SD*	*M*	*SD*		
Pre-test Cloze	6.64	3.76	9.09	4.71	.095	.002
Post-test Cloze	9.36	4.82	12.45	6.68		

potential ceiling effect.

Prior research has found that vocabulary is a strong predictor of comprehension ability among adult learners (Landi, 2010). Likewise, Tighe and Schatschneider's (2016) meta-analysis found that oral vocabulary is a strong predictor of reading comprehension for adults. Additionally, the meta-analysis included five additional strong predictors of reading comprehension: morphological awareness, language comprehension, fluency, real word decoding, and working memory. These studies may be useful in informing future research regarding screening tools adequate for identifying individuals that may benefit from reading comprehension interventions. The current study did not include a measure of participant's vocabulary, which could have been used as a screener or covariate. That is, eligibility criteria that limited participation to struggling readers may have increased the relevance of CSR to the participants. However, in the context of the current study, the provision of CSR to a college population without an eligibility criterion appeared to be a reasonable approach, given the high rate of expository reading challenges generally found in said population (Grandstaff-Becker, 2006). In the same vein, CSR has proven to be beneficial for students across a range of reading abilities, including typically achieving students (Boardman, Klinger et al., 2015).

Research on reading comprehension using CSR has predominately occurred in K-12 schools. Previous research that found main effects on reading comprehension using CSR generally incorporated more intense treatment than the current study. Additionally, most of these studies had teachers implement CSR during a semester or school year for K-12 students. For example, one of the studies finding large effects for CSR intervention was implemented over an entire school year to measure the effectiveness of the intervention on students' reading comprehension (Klinger et al., 2004). Another study had seventh- and eighth-grade middle school teachers implement CSR for 50 minutes a day, two days per week, over roughly 18 weeks (Vaughn et al., 2013). Each of these studies found that the CSR intervention did significantly improve reading comprehension in students. These studies may indicate that the current study's treatment intensity was insufficient. In the current study we implemented two 60-minute sessions per week over four weeks. In other words, the current study may have needed a more intensive or a more targeted intervention to find an effect for CSR on reading comprehension in college students.

Participants in the current study were randomized into either the control or intervention group once pre-test measures were completed. At the time of randomization, researchers did not realize that the Cloze passages were unbalanced between the two groups. Specifically, the control group administered Cloze passage F disproportionately, while the intervention group was mainly given Cloze passages B and C. This unbalanced distribution may have contributed to group differences favoring the control and the absence of a significant effect for the treatment by time interaction in this study. Cloze passage F might have been an easier passage, and if such was the case, may have led to the control to have a higher reading comprehension score at the beginning of the study. The current study's null effects could have been due in part to the distribution of test passages across conditions.

It is also possible that the file drawer problem in scientific publication may have indirectly contributed to our null findings (Wagner, 2022). The file drawer problem emerges when researchers who obtain null results do not attempt to publish their findings or journals reject studies with null results. Studies similar to the current study may have been attempted previously, but the current researcher could not find that information because null results are not typically published. Accordingly, it is possible we replicated previous, similar studies that did not obtain statistically significant effects, of which we are unaware.

Researchers hypothesized that low reading comprehension would be associated with low self-esteem, based on previous research suggesting a link between academic self-worth and reading comprehension. However, this study did not find such a correlation. For example, Rosalina and Nasrullah (2019) identified a positive relationship between college students' reading comprehension scores and self-esteem. Similarly, studies involving Iranian adults learning English as a second language reported correlations between reading comprehension and self-esteem (Bagheri & Faghih, 2012; Piran, 2014).

Similarly, we did not find a significant correlation between mental health outcomes and reading comprehension. In a systematic review examining the relationship between global literacy abilities and mental health in adults, researchers found multiple studies finding a significant relationship between low literacy and poor mental health outcomes (Hunn et al., 2023). Previous research has also examined the relationship between reading ability and mental health outcomes in school-aged children. Reading ability was found to be negatively correlated with positive mental health outcomes. Self-esteem moderated the relationship between poor reading ability and mental health outcomes (Boyes et al., 2020). In the current study, there were significant correlations between all the subscales in the DASS-21. These results are in line with previous studies using the DASS-21 (Osman et al., 2012). These correlations between the DASS-21 subscale were expected to be significant.

In addition to the issue described above, specific aspects of our study's recruitment and requirements may have contributed to the null findings. By recruiting participants early in the academic semester and demanding more time commitment than their introductory course's minimum research participation requirements, selection bias might have resulted. This could mean that the participants possessed better time management skills and higher academic motivation. Furthermore, students needing reading comprehension support may have felt anxious about acknowledging their need for academic assistance early in their college career. Consequently, these students may have been reluctant to participate in our study or lacked the time management skills necessary to accommodate it in their schedules. Collectively, these issues would have decreased the ability of CSR to yield effects for students who may have had relatively adequate or advanced skills.

Limitations

Although a power analysis was conducted and the sample size of $N = 47$ was achieved, no significant results were found. The current study revealed an effect size of $\eta^2 = .002$, suggesting that only 0.2% of the variance could be attributed to the intervention, which is exceedingly small. This effect size indicates that CSR lessons do not have meaningful relevance in this context. Another limitation of the study was the treatment intensity. Previous research typically exposed students to CSR lessons multiple times a week for at least a semester (Boardman et al., 2015; Klinger et al., 2004; Vaughn et al., 2013), whereas the current study required students to attend only six lessons. Increasing treatment intensity may be necessary for CSR to be effective in enhancing reading comprehension skills. Conversely, it is possible that the CSR intervention is not well-suited for a college population, as most research demonstrating CSR effectiveness has been conducted in secondary school settings rather than at the college level. The imbalance in Cloze passage forms across conditions represents a methodological limitation. Finally, the distribution of Cloze passage forms across conditions was not preemptively balanced, which may have introduced systematic differences between groups. Future research could address this limitation through stratified randomization or counterbalancing procedures to ensure equal representation of each passage form.

Conclusion

The absence of significant findings may be attributable to several factors. First, participants who volunteered early in the semester and committed extra time may have possessed higher reading comprehension skills and stronger time management than typical college students, potentially limiting the scope for improvement. Second, the CSR intervention may have been insufficiently targeted or intensive for a college population, either because the material was too simple or the duration too short to produce measurable gains. Future studies could include screening procedures to identify students with weaker reading comprehension skills or collaborating with university academic services to recruit participants who would benefit most. Additionally, a more intensive and targeted intervention designed specifically for college-level expository reading may increase the likelihood of meaningful effects.

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